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EXPLORING LIFE

The Autobiography of

THOMAS A. WATSON

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THOMAS A. WATSON

Exploring Life

The Autobiography of

Thomas A. ugustus Watson

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THOMAS A. WATSON . . . . . . *Frontispiece*
Medallic Portrait by Theodore Spicer-Simson

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EXPLORING LIFE

CHAPTER I

I CANNOT begin this story of my life with an account of distinguished ancestors. Years ago a genealogist looked up my forebears. Tracing them back three or four generations, he found farmers, mechanics, laborers, one or two school-teachers and a preacher or two. Then he lost the thread in the defective records of New Hampshire towns and could go no further. He did not even carry me back to the *Mayflower!* The most interesting individual he discovered was an ancestor who started the Free Will Baptist Church in this country. He was probably a strict sectarian but he handed none of it down to me.

One day, I told a friend who was an astrological enthusiast the date of my birth—January 18, 1854—and described to him the situation of the house wherein I was born, which overlooked the activities of a large livery stable. He studied his mystic charts for a while, and then triumphantly asserted that my birthplace had been determined by the constellation Auriga, the charioteer. The horoscope he cast for me was not convincing but it cannot be denied that the house wherein I began this life was in the center of all the charioteering business of the good old city of Salem, Massachusetts, for about it was concentrated nearly all the transportation facilities of that region that depended on horses.

An alley leading from Essex Street between two brick buildings expanded into a large yard about which the wooden stable structures were clustered—a long building where a hundred horses were kept and many tons of hay lofted, a harness house and several open sheds under which were stored, when not in use, a multitude of buggies, carryalls and coaches. And in a corner of the yard, entangled in the stable buildings, near where Billy Egan washed and polished the vehicles, was my birthplace and boyhood home, a two-story-and-a-half, pitch-roofed, clapboarded, unpainted house, in which we lived because my father had to be on hand to attend to emergency calls for teams coming at all hours of the night.

That busy stable was dingy and commonplace but I am sure Hawthorne, who immortalized the town pump just across the way, might have found there plenty of material for his romances in the men and women who came there day and night on all sorts of errands that needed the help of horses—parties, weddings, intrigues, elopements, sicknesses, funerals.

The best harnesses and carriage robes of the establishment were kept in the lower rooms of our house.

Our family quarters were on the other two floors where eight of us lived—my father and mother, two half sisters, two sisters, Uncle Joe who worked in the stable, myself and occasionally one of my half brothers when he was home from sea.

My father, who was broad-shouldered, muscular, and usually good-natured, had as his principal interest in life horses and their appurtenances. As foreman of the stable he was on duty from early morning until late at night, seven days a week, so we children saw little of him except at mealtimes.

My mother, who seldom left home, was quiet, hard-working and efficient in all household affairs. She, assisted by one of my half sisters—the other worked in a tailor's shop—kept our house exquisitely neat and clean. They washed, ironed, scrubbed, mended and cooked all day and every day, winding up the week's work by scrubbing us youngsters in a washtub every Saturday night. There were no conveniences to lighten their labor. All our fuel and water had to be tugged up two flights of stairs from the dark, wet, cobwebby cellar—a duty that devolved on me at a very early age.

This atmosphere of household drudgery in which my childhood was passed and the constant care I had to exercise not to add to my mother's burdens, have influenced me all my life in such ways as a meticulous use of a doormat, distress if I tear or soil my clothes or spot a tablecloth, and, especially, in the pleasure

I have always had from any device that simplifies and saves labor.

We always had plenty to eat and were decently clothed, but my mother never spent a cent unnecessarily. She practiced herself, and preached to us children, saving for a rainy day, and managed so well that when my father died he left more than two thousand dollars in the savings bank, every cent of which was saved by mother's economies. This early economy also got so bred into my bones that, to this day, waste of any kind, whether it be of labor or material, is abhorrent to me.

However, there are touches of beauty in my recollection of my early home, especially the morning-glories my mother grew in our tiny back yard. Never have I seen any flowers so exquisite as those purple morning-glories trained on strings by the back door, their loveliness enhanced by their shabby environment.

And a great ash tree, too, growing in the stable yard near our house adds a bit of charm to the picture when I recall my birthplace. From an easily accessible branch, I often watched the activities in the yard below, romancing about the strangers who came there. I remember, too, tragic events connected with that tree. It was inhabited by song birds we all loved and our cat hungrily sought the nestlings at every opportunity. With sticks and shouts we often rushed to the rescue but in spite of our most frantic efforts, I am afraid pussy got many a delicate meal from our ash tree.

That cat was an important member of our family and when she died our sorrow was attested by general weeping. To mitigate our grief, an ingenious friend stuffed and mounted the skin for us, but it was not a success as a consolation. Its ugliness scared me, especially the mouth, which was badly puckered and showed the straw inside, and the glass eyes that glared on me alarmingly. Moths did their best to relieve my childhood of this fearful object, but did not add any beauty to it, and what the insects left of the fur, I used a few years later as an exciter for a frictional electric machine some one gave me.

My only playground was the stable yard and its buildings. In the big wooden trough from which the horses were watered, I sailed my shingle boats. I thought the animals were interested in my argosies for they always snorted at them when they drank, but I was often anxious for fear some highly prized ship might be drawn into the red abyss of a thirsty mouth before I could rescue it.

For playing hide and seek the carriage sheds were most satisfactory, but my best fun was in the great hayloft filled with fresh hay from the country in which I and other boys dug long tunnels and played Indian. And when we got hungry between meals there was a bin of juicy carrots intended for the horses, to make their coats glossy, but which we relished as much as they did.

Christmas was an exciting time. We youngsters got up early in the morning to steal out on the stablemen and shout "Merry Christmas," expecting and usually receiving a cent from each, which was the mercenary object of our greeting. Their strange return greeting, "Christmas Pot on yer," did not seem to us as pretty as our formula.

Fourth of July was distressing, for my ears as a child were very sensitive and an explosion even of a small firecracker was painful. A locomotive whistle was a horror. There were sounds I liked, for as far back as my memory goes I recall listening with pleasure when certain persons were speaking, even if I did not know what they were talking about, and getting away out of hearing of other voices I did not like.

As foreman of the only large livery stable my father was usually consulted about affairs in the town that required the hiring of horses, and many who patronized the stable, evidently feeling under obligation to him for favors received, presented him with turkeys every Christmas and Thanksgiving. I have seen six or eight of the birds hanging in our cold entry at once. As there were more than we could use, my father gave most of them to his friends.

The arrival of the turkeys always interested me, although I disliked meat for food. My mother accounted for my prejudice by the theory that my stomach had been turned by seeing her prepare a chicken one day. Whatever the explanation was, I ate meat only when my parents obliged me to do so, which they often did, as a vegetarian diet was then considered inadequate for any one.

Few of the town folk in those days kept their own horses and carriages, and when they needed teams hired them from the stable. Some of the customers insisted that my father should drive them with his special team—a pair of lovely white horses and a new barouche. I often rode on the seat with him envied by all my boy friends and enjoying the ride, I am sure, as much as the folk inside who never objected to my presence on the driver's seat.

And I had other enjoyable rides. Part of the equipment of the stable was a big sleigh that would hold forty or fifty persons. Its body, shaped like a boat, had the appropriate name, *Neptune*, painted on its sides. When the sleighing was good the *Neptune* was often engaged to take parties to some country hotel for a collation and dance. Among my earliest recollections were the occasions when I was taken along, perhaps as a mascot for the party. Such sleighing parties were always fair game for snowballing. Volleys of snowballs were discharged at the sleigh as it made its way through the streets and plenty of similar ammunition was hurled back at the enemy by the merry sleigh riders who were, indeed, as often the aggressors as the men and boys on the sidewalks. While these battles raged, I was placed in the bottom of the vehicle out of danger. If a snowball grazed me I never failed to weep loudly, not because I was hurt, but because I wanted to be petted.

Although a child's environment is undoubtedly an important factor in the development of his character, much with which I came in contact during my impressionable years repelled rather than allured. Brought up in intimate contact with horses and stablemen, the more I saw of the business the less I liked it. I never wanted to drive a horse when a boy and still dislike doing so. My father and all the stablemen smoked, but tobacco never was a temptation to me. Whisky and water was the wine of the country and considered necessary to one's well-being. Nearly every man I knew drank several glasses of that beverage every day without any attempt to conceal it. Whisky was easily accessible to me but I never cared to experiment with it and have been practically a teetotaler all my life.

CHAPTER II

WHEN I was five years old I was taken to Miss Fogg's private school where very young children were taught for twenty-five cents a week. I have in my mind a clear picture of the schoolroom in her house and the children sitting around it on benches, but I do not remember ever learning anything. A children's party there remains clearly in my memory for on that occasion I had, for the first time in my life, all the cake and candy I wanted. There must have been a shortage for I recall my grief and resentment when the women in charge found there was not enough to go round and had to take some off the plate of each child who had been served to put on the other plates. This forced contribution caused general resentment but no one howled louder than I did.

Two or three years later I was taken to a public school and although I have not the faintest recollection of studying anything there, I presently found I could read. But no one, until I got into high school, ever suggested that I should write anything. When I was twelve years old I could not write as good a letter as my seven-year-old grandchild can to-day. Our modern public schools may be deficient but they are vastly superior to those of my childhood.

After I had mastered that art, reading became one of my principal pleasures. I owned *Robinson Crusoe* and a few other boys' books which I knew by heart, but Beadle's and Munro's dime novels furnished a good share of my reading. There was no public library in Salem but a stationer had a few books, mostly novels, that he lent for two cents a day. For years I went there every Saturday and selected a book for my Sunday reading, Mayne Reid and Dumas being my favorite authors. I always read my book in one day which gave me a habit of skim-reading that has troubled me all my life, for although it is easy to glance through a book and get its general meaning, when it is necessary for me to read carefully I have to force myself to do so.

Neither my father nor mother ever went to church, but they evidently believed it was good for their children. For many years I was sent to the Baptist church twice each Sunday to squirm through the long, unintelligible sermons. And between the two church services I had to spend an hour in Sunday school sitting in a pew with a string of bored and restless boys while the teacher, looking over the back of the next pew, encouraged us to stumble through the day's lesson.

The effect of so much enforced church attendance in my childhood was an intense dislike for churches and preachers which I have never entirely overcome. And listening so much to the poor organ in that church has spoiled organ music for me ever since. Even now, an organ seems to sing through its nose no matter how good the instrument or how skilled the player.

One of the Sunday-school papers which were given to the children each week brought into my life its first great fear. It had a story of a boy who did something boyishly naughty. One night, the story ran, his house caught fire and he was burned to death. I had become used to hearing the minister describe the good old-fashioned hell he delighted to portray, so that it did not frighten me at all for it was too remote a contingency. But, living as I did next a hayloft and knowing the precautions taken in the stable against fire, the detailed description of the burning of that boy, written evidently by an expert in the art of scaring boys into being "good," made such an impression on me that for many years I went to bed in an agony of fear lest I should be burned up in the night, often awakening, if disturbed, in a terrible fire nightmare. I must have been fifteen years old before I outgrew the effect of that shock to my young nerves coming from that Sunday-school paper.

There was one part of the church service I enjoyed. I found a fearsome pleasure in witnessing the ceremony of baptism when it was occasionally performed, after the morning service, in the tank which came into view when the pulpit was rolled back. I caught my breath in sympathy with the recipient of the rite, usually a woman, when the minister swayed her backward under the water, and was immensely relieved to find she was still alive when he brought her up again and wiped her face with his handkerchief.

Being an obedient boy, I submitted to this church and Sunday-school program until I was about ten years old, when, one warm Sunday, I tried the revolutionary experiment of sitting outside the church during the service. I found it vastly pleasanter to sit in the open air dreamily watching the birds than to listen to the droning sermon inside. Mixed with my stolen pleasure was the fear of being found out and punished for my truancy. I stayed near the church for I had no way of knowing when to go home except by the congregation coming out. When I went to work in a store my parents no longer insisted on my going to church. Then, I spent my Sundays reading or roaming in the woods.

The conception of God I got from the sermons I heard and from Sunday school was that of a stern, vindictive giant sitting on a big white throne above the sky, watching me very sharply. The theory of a heaven or a hell beyond the grave as a reward or punishment did not trouble me much, for death to a healthy child is a very remote contingency. I noticed a variety of opinions among grown-up people about what it was necessary to do in order to get to heaven, and had read in my Sunday-school paper that deathbed repentance was efficacious for salvation even if one's life was as wicked as I was sure mine was, so I felt safe to wait before deciding what plan to adopt.

A few of my boy friends became "converted" from time to time but I never noticed any striking difference in them after it. My Sunday-school teachers tried to convert me and I tried my best to be converted, for even at that early age I loved a new sensation. But somehow it never "took." The nearest I ever came to a "change of heart" was during severe thunderstorms, but my heart always promptly changed back to its unregenerate condition when the sun came out.

I thought at that time that the reason why my earnest endeavors to "get religion" failed so completely must be due to some serious defect in me, but I believe now that "conversion" is a word vaguely expressing the greatest attainment possible to a human being—the consciousness of our unity with the soul of the universe. It is the highest goal we can know and it cannot be reached by any amount of mere striving, for it is a matter of the evolution of the soul through the ages. Those who have fully attained it are the great seers, prophets, saviors—

the world's supermen. I believe it is to be universal to all mankind. I do not expect to attain it in my present life, but believing as I do in reincarnation, I have faith that it will be mine in some life to come.

The most notable example of "conversion" that came under my notice was that of my friend, George Phillips. When he was about twelve years old he got a job in a bookstore where he slept nights in a bunk under the counter. One morning he came to my house with solemn face and bulging eyes and announced that he was converted. He told me that, the night before, burglars had broken into the store where he was sleeping. Their rummaging about awakened him. When he realized they were robbers, he thought he would be murdered if they found him. So he lay perfectly still, praying to be saved from that fate, promising God if he escaped he would get religion and be good ever after. The burglars departed after a while and George felt so relieved he was sure he was converted. He became an ardent propagandist and tried to convert me and the rest of the boys. The effect of his scare lasted him nearly a week before he became his old self again—much longer, however, than any of my thunderstorm conversions.

However, I am sure some spiritual insight came to me in those days. Even as a child I liked to get away by myself and dream about things until the commonest objects became new and wonderful. I remember particularly one sunny morning sitting on my back-door steps looking at the morning-glories when suddenly they began to talk to me. I understood but I never tried to put it into words, for it did not seem necessary to do so.

And I found a secret nook high up on the roof of the stable, which I reached by climbing through the scuttle of my house. Out of sight and sound of the busy scenes of the stable yard, I often sat there alone in the twilight with a delightful feeling of being part of the sky and on good terms with God. Later in my life, when I began to take long walks in the woods and on the seashore, this sense of an intimate relationship with everything—the birds and squirrels, the grass, the trees, the water and the sky—became so strong that I would lie half the afternoon in some quiet nook, miles from home, in a rapturous dream.

All these dreams seemed important to me then, but I never told any one about them, perhaps because, when I was not dreaming, I was afraid these blissful moments might be just laziness. But my childhood had no greater happiness than what my dreams brought me. I fancy, if I had been born in India, I might have been content to spend my life in meditation but that can hardly be done in our country where the impulse to work and get ahead in life dominates and leaves little time for philosophizing.

George Phillips was about my age and I often went to his home. One evening, when we were eight or nine years old, his mother, a widow who earned her living by binding cloth shoes, suggested that we put our fingers on the table and ask the "spirits" to knock. It was a new game and we followed her suggestion. Instantly we heard taps coming from the table which increased to loud knocks and then the table suddenly reared up on two legs. Horribly frightened, I grabbed my hat and ran home, expecting every moment to be seized by a ghost. I didn't get over my scare for a long time and after that evening when I was at George's house, I kept away from that table fearing some ghost might start it going again if I touched it. Some four or five years later, however, I renewed my experiments with Phillips in this line with astonishing success, as will be reported further on.

I had another miserable experience at about this time. I fell in love! Five pews in front of mine in church, sat a girl with long brown curls. She was rather pretty, but those curls were quite the most fascinating things I had ever seen. They thrilled me even more than the woods and the sea I was so fond of. I never spoke to the girl but her curls haunted me. I found out her name and took intense pleasure in uttering it aloud when no one could hear. I was too bashful to try to get acquainted with her; possibly if I had my illusion would have vanished. I worshiped her at a distance, and always in church; I do not remember that I ever saw her on the street.

Being in love was a distressing malady. It lasted at least six months and was at its height when the girl disappeared and I saw her curls no more except in my mind. Gradually they faded from my memory and I was again captain of my soul, much ashamed that I had been so upset by a girl.

I used to play the usual boys' games but not very energetically. I had half a dozen boy friends who lived near, with whom I had an occasional game of baseball, in which I never shone, for I was a poor hitter and a poorer catcher, being nearsighted, although I didn't find it out till years later. The game I liked best was to go to the town pastures with the other boys and play Indians. Sometimes we would play with a raft on the mill pond, but that sport came to an end when George Phillips tumbled into the water one day and nearly drowned. That was before we learned to swim for, although we went bathing in a shallow basin near the North River, we didn't learn that art until two or three years later.

Every fall we would go nutting for hickories. In winter we built snow forts in some back yard larger than mine. Sometimes we fished for cunners or flounders from the wharves or bridges. The scarcity of fish must have led us to devise a new sport, which was angling with a pole, line, and bent pin, from the roof of a carriage shed, for rags and papers in a dust bin that held the sweepings of a dry goods store and was conveniently located for our purpose.

My chief and never failing boyhood delight was roaming alone at every opportunity through the woods and pastures. I became familiar with every rod of the country between Salem, Swampscott and Marblehead. My favorite walks were to the beaches, then entirely unsettled. Summer houses had not come into fashion or New England people were not rich enough to build them.

As I grew older I sometimes had adventures on my walks I should not care to mention. They came from my love of experimenting and avidity for new experiences. As I think of one or two of these incidents they seem like poking lighted matches into gunpowder.

The shore ledges interested me greatly, most of them a puzzling tangle of dark and light-colored rocks. I knew they were trying to tell me a wonderful story but I didn't know a word of their language. I had some small pieces of the common minerals which I sometimes took to the beaches to see if I could identify them in the rocks but never succeeded with anything except quartz. My interest in rocks, beginning then, has lasted all my life, a source of great pleasure. It led to my taking a course in geology many years later.

Every year in October my father and mother went down east for a fortnight's vacation and sometimes took me with them. We spent the time with farmer friends in the country a few miles from Biddeford, Maine. Gunning for partridges and gray squirrels was father's amusement on these trips, although he shot any wild animal he saw. There were usually a couple of boys with us about my age who had small shotguns which they would occasionally let me fire at a target, but only once did I kill anything. One day, dared by the other boys, I crept up to an apple tree and shot a robin; remorse seized me instantly and the memory of that dead bird has haunted me ever since.

CHAPTER III

WHEN I was about eleven years old I went to work in a crockery ware store that backed on the stable yard. I swept the store before breakfast and did errands between school sessions and on Wednesday and Saturday afternoons, all for fifty cents a week, which I deposited in the Salem Five Cent Savings Bank where I had had an account since I was six years old, when my sister went with me to deposit a dollar—the sum total of my accumulated pennies to that date.

The work was hard for such a small boy. Goods that were sold while I was in school were placed on the floor in front of the counters, marked with the addresses of the purchasers, ready for me to deliver when school was out. Although it was the largest crockery and kitchen furnishing store in Essex County, I made all deliveries of goods, lugging them on my arms in baskets or in bundle handkerchiefs. If more things were going to a part of the town than I could carry on my arms, they were packed into a wheelbarrow or, in winter, into a big box sled, which I tugged about. No such extravagance as a horse and wagon was indulged in by any store in town.

On rare occasions after the horse cars started in Salem, I was given a three-cent car ticket for a particularly heavy or far distant delivery. But I usually walked even then and bartered the ticket at the cent shop for a cake or turnover and felt fully recompensed when I ate it. More than once since those days I have looked for such triumphs of the baker's art but the secret must have been lost, for never have I found any cakes or pies with anything like the old deliciousness.

The only pleasure my work as delivery boy gave me was putting my weekly fifty cents in the bank. I was always disgusted when, entering the store after school, I saw on the floor a long line of things for me to transport, and I remember the joy of the rare occasions when, business being dull, there was little or nothing for me to do and I could go play with the other boys. But, laborious as it was, I do not think this early work did me any harm. Perhaps it was beneficial in correcting my tendency to read and dream too much.

After a year or so in the crockery store I got a job in a paper-box factory, where for seventy-five cents a week I swept the floor in the morning and helped paste boxes all the time I was not in school. After a few months of this, I went to work in a ready-made clothing store for a dollar a week, working evenings as well as mornings and between schools. In addition to sweeping, dusting, and cleaning windows, I now waited on customers, having charge of the necktie and paper collar counter. Occasionally I sold a pair of pants, always ironing out the now fashionable crease before the customer would take them, for the crease indicated ready-made pants which were not worn by the fashionable. Custom-made trousers always had uncreased legs resembling stovepipes.

One-price clothing stores were rare in those days. In our store the cost of every article of clothing was marked on it in a secret code to which we added one-half as the asking price to a customer, but if he drove a hard bargain, as he usually did, we would dicker with him, gradually reducing our price to what he was willing to give.

One busy Saturday evening, in dealing with a new customer I tried the audacious experiment of quoting for a suit of clothes a price that was double its cost instead of adding 50 per cent, expecting the usual bargaining. But to my surprise the man took the clothes without question at the exorbitant price I had put on them. My employer praised my shrewdness but my conscience has carried the weight of that overcharge ever since.

The head salesman of this store was the first ugly-tempered man I had ever met. He kept the store keys and, as he wouldn't trust me with them, I had to walk the half mile to his house every morning to get the keys before I could sweep the store. I bruised my knuckles knocking at his door, until he came to the window in his night clothes and flung the keys down to me, invariably rasping at me with his fault-finding.

His scoldings got so badly on my nerves that when I awakened one cold winter night as light as day from the full moon shining on the snow, I thought it was the sun, and springing out of bed half awake, dressed myself and rushed uptown after the keys. Just as I was about to knock at the clerk's door, a church clock struck the hour of one which brought me to my senses and then, realizing why the streets were so strangely deserted, I went sheepishly homeward, encountering on my way the town watchman who questioned me sharply as to my business on the streets at that hour. I don't remember what I told him but I was mighty glad to get back to bed.

Between my sixth and thirteenth years I attended four different schools. The details of my work in them are very hazy in my mind probably because the work was so uninteresting. I remember chiefly the frequent thrashings the boys got from some of the teachers who seemed to delight in punishing for the least offence. But some of the women teachers I recall were kind and patient with us.

I was usually second in rank in my classes and never envied the boy who stood at the head for I noticed he was the principal victim when the teacher wanted to show off her pupils to a visitor. My satisfaction with my rank increased when the boy, who for one whole year had been at the head of my class, died of consumption. It seemed a narrow escape for me and I told my mother on the day of the boy's funeral that the boy ahead of me in the class always died, but that startling generalization was based on that single observation.

I learned little in these schools. When I was eleven years old I could read well to myself but had never been taught to read aloud with expression. I wrote a poor, cramped hand. I had memorized pages of grammar but had had no composition work. I could do simple problems in arithmetic slowly and inaccurately but no teacher made any application of my number work to practical matters. I memorized dull pages from the history book but no one ever suggested that I study Salem's rich history or visit its interesting museums. I knew islands and capes on the map but never had my attention called to examples of them on our shores. There was no nature study nor manual training in the schools of my boyhood.

High school, which I entered at the age of thirteen, was better. There I had English composition for the first time and very poor work I made of it. We studied French, Latin, English literature, algebra, geometry, natural philosophy, and declamation; truly a feast after the meager fare of the lower schools. Although I learned at high school only the rudiments of these subjects they made it vastly easier for me to continue their study later in my life. I have often heard the assertion that only a few subjects should be taught in our public schools, though in them the children should be thoroughly drilled. That is good, provided the subjects be not too few, but my experience convinces me that it is better to give a child as many glimpses into the vast treasures of knowledge as possible for he is much more likely to go further in a subject to which he was early introduced even if that acquaintance was but slight. All I learned at high school was a mere smattering of the subjects taught there but the tastes I got gave me a strong desire for more that has lasted through my life.

But I wanted to go to work and do something toward relieving my mother of some of her drudgery and get her a better house to live in. After a year and two months in high school, I told my parents I was going to quit. They made no objection and I went to work as a clerk in the crockery store where I had formerly been errand boy, ending my early schooling at the age of fourteen.

My decision to leave school was hastened by a novelty the new principal introduced at the beginning of the second year. He made the boys declaim before the boys and girls instead of before the boys alone as had been the custom. Declamation was a fearsome thing to me and bringing the girls in to witness my pain made the ordeal unbearable.

My disgust at my failure as a declaimer at high school fixed my attention on that accomplishment and, for some time after I left school, that was the only study I kept up. I memorized the poems and speeches in my reading books and on my solitary rambles used to declaim them to my sympathetic intimates, the trees and rocks, imitating as well as I could a young man of the senior class at high school whose beautiful speech I had admired and envied. I have never lost my interest, which began at that time, in the cultivation of the speaking voice. It has been a hobby all my life—an instance of the well-known fact that one's weakest point may become his strongest.

I had now attained the exalted position of a clerk and did not have to deliver goods. I unpacked crockery from the crates in which it was shipped from England, washed it and put it on the shelves, swept and dusted the store every morning, waited on customers, filled cans with kerosene oil, sold shoemakers' tools and flowers in pots, besides crockery and glass, put up flower seeds in little packages and labelled them, and made myself useful from 6 A.M. to 9 P.M., with an hour for dinner and one evening off each week. My wages were five dollars a week, of which I gave my mother three dollars, and put the rest in the savings bank.

At this time I had my first contact with death. My Uncle Joe died after a few days' sickness. I had no trace of a religious reaction from the event. My chief feeling was resentment that my kind uncle, for whom I had quite as strong affection as for my father, should be so ruthlessly deprived of life. His small belongings were divided among his relatives. My portion was a little pearl paper cutter. I soon got over my grief and resentment and in a few weeks was sufficiently philosophical about his death to have the thought, "What a mess it would make if Uncle Joe should come back and claim his widely distributed things."

After a year in this store I became dissatisfied for I could see no chance for advancement. When I was sixteen I decided to take a course in a Boston commercial college, hoping that would open up a better prospect for the future. I kept my job in the store, working there afternoons and evenings while I spent six months in this school, going back and forth between Boston and Salem on the train. In that time I got a good working knowledge of double entry bookkeeping and the rudiments of banking and commercial law. My penmanship improved immensely and so did my power to figure rapidly and accurately. The methods of instruction were sensible and practical and I am sure I learned more in that six months than I had in the last five years of my public-school life.

I expected to get a position as bookkeeper in some Boston concern when I finished my commercial course, but the hard study hurt my eyes and the oculist I went to advised me to get work that would not require writing all day. He prescribed glasses for my distant vision—I needed none for reading—that gave me a new joy in life, for when I put them on new beauties appeared in everything I saw. Each leaf and twig of the trees was now distinct and the stars were points of light, not little blurs as my natural sight had made them appear. Very few young people wore glasses at that time and for a long time I was ashamed to let my friends see me wear them so I wore them in Boston or in the woods but never in the streets of Salem.

When I finished my work at this school I went back to the crockery store for eight dollars a week as bookkeeper and cashier as well as salesman. It was a disappointment that my eyes would not allow me to take a Boston position that was offered me, but I soon forgot it in the interesting work of utilizing in practice in the Salem store, my newly acquired knowledge.

I was still almost as bashful when I met new people as I had been as a child and realizing that it was a handicap I tried to rid myself of it by taking dancing lessons and going to the assemblies that followed.

But it didn't help me much. In fact, I have never fully overcome it. Although I have lectured, read or played to hundreds of audiences I am still very reluctant to meet people. I don't visit even my oldest and dearest friends as much as I ought and never make a formal call if I can avoid it, in spite of the keen enjoyment I have when I get into actual contact with people whether they be old or new friends, or strangers. I am a poor mixer before I mix, but a better one after I get mixed.

But I soon lost my interest in bookkeeping and, becoming hungry for new experiences, decided to drop it and learn a trade. Not having a bias toward any particular trade I took the first chance to learn one that offered. A local carpenter took me on as an apprentice and sent me with a gang of huskies to frame and raise a large dwelling house at Beverly Farms. That was too much of an experience for me to jump into without preparation for I quickly learned that kegs of nails and twelve-inch timbers are startlingly heavy and that it required strong nerves as well as muscles to straddle a third-floor plate and nail heavy floor beams in place. Not being built for such work I was completely exhausted at the end of each ten-hour day during which I was expected, and tried, to do my full share of the work. I kept at it for a few days but, soon realizing it was not the right job for me, gave it up and renewed my search for a chance to learn a trade for which

I was better fitted physically than I was for carpentering, and after a few odd jobs, found just the kind of work I liked at the machine shop of Charles Williams, 109 Court Street, Boston, and began work there on July 1, 1872.

CHAPTER IV

GETTING this job at Williams' was a turning point in my life but I had no premonitions of important events ahead. I was happy because I had found an interesting and manly trade that would enable me soon to earn three or four dollars a day, which seemed quite all I should need to live on and to save for my old age. From the time in 1861 when I deposited my first dollar in the savings bank, my savings had grown until they were now two hundred and forty dollars. If I could save so much on such small pay as I had earned, what could I not do with a journeyman's wage of three or four dollars a day! By the time I was fifty I could surely have twenty thousand dollars saved and invested, the income from which would be enough to supply any want I should ever have!

Such were my happy visions of the future as early in the morning and late in the evening I traveled on the train between Boston and Salem to and from Williams' shop in which my life was now firmly centered.

In the 1870's this was a very different world, as far as the practical use of electricity was concerned, from what it is to-day, fifty years later. At that time no university in the world had ever offered a course in electrical engineering. The principal use of electricity then was for telegraphing and for fire alarms. This required the use of a variety of apparatus—keys, relays, sounders, registers, switchboards, galvanometers, and a few printing telegraph instruments, all of which Williams made and sold in small quantities. He also made electrical call bells, gongs, annunciators for hotels, galvanic batteries and apparatus for schools. It was a meager list compared with the immense variety of electrical machines and appliances that are in common use to-day.

The great electrical workshops of to-day, employing tens of thousands of skilled mechanics and carrying on research work by hundreds of trained scientists, were unknown in the 1870's. Then, the meager list of electric apparatus in use was constructed in a few little shops scattered through the States, most of them earning a precarious living for their owners by making and selling the machines I have mentioned.

Williams' was one of these little shops. It occupied the third floor and attic of a building at 109 Court Street, Boston. He had about twenty-five men when I went to work for him and during my apprenticeship that number was seldom exceeded. I was taken on because he had received an order for some printing telegraph machines of a new type and my first work was on some of their minor parts. When the machines were finished, I was given parts of other instruments to make and as I became expert in making the simpler parts, more difficult ones were assigned me.

Williams' main shop was in a large loft. Its brick walls had once been whitewashed but now only patches of dull white showed here and there through the grimy dust that gave the dominant color note to the place. Near the windows, both front and back, were a dozen or twenty metal-working hand lathes with slide rests and two small engine lathes, one quite new, the other old and dilapidated. Overhead a tangle of racing leather belts and whirring pulleys hid most of the dusty beams and ceiling. Along the center of the room were wooden racks holding steel, iron and brass, sheets and rods, and on the floor, piles of rough castings, all of which was raw material for the apparatus we made. A sink where the men washed up and a small forge for annealing and tempering completed the outfit of the shop. One corner of the loft was partitioned off for the office and salesroom where the finished machines we made were displayed in glass cases.

My work was intensely interesting except when several hundred pieces all alike were given me to make. I found such repetition work tiresome at first but soon found a way to lessen the monotony of such a job by observing my movements at the lathe or vise when I was doing the work, trying to reduce the motions to the fewest possible and to blend them so that a new movement began before the previous movement ended, and using the same sequence of motions for each piece in turn. Such jobs then became quite automatic and the pieces were finished so quickly that the job lost its tediousness. Elimination of useless movements in doing work is now an important part of scientific workshop operation, but I never heard of its being done until years after I had made it a part of my daily routine in the early 1870's.

My desire for new ways of working also led me to devise special tools to hasten the work and improve its quality. I often lay awake all night excited by an idea for such a tool that had occurred to me on the train or on my evening walk and the success of one of these devices always gave me the keenest pleasure. The ideas were not always original for I read all the books and magazines I could get hold of to find suggestions to help me in my work.

The result of my methods of doing work was that, before two years had passed, I was rated in the shop no longer as an apprentice but as a skilled journeyman who could turn out work with such notable rapidity that, when dull times came, I was never laid off, and more important still, although I did not foresee it, my study of work movements and labor-saving devices was to be a large factor in my success as an electro-mechanician and in my being chosen to do the pioneer work on one of the world's greatest inventions.

Although Williams' shop was dingy and ugly, and crude in all its arrangements, from my first day there I was happy and contented. And when I grew more skillful in using tools and was entrusted with the construction of complete machines, I often felt an exaltation in my work akin to the ecstasies of my lonely walks. In the woods I felt myself a living part of all creation; now I thrilled with the knowledge that I myself was creating as I made stubborn metal do my will and take the shape necessary to enable it to do its allotted work. I should have been surprised then if any one had called those moments poetic but I know now there was some noble poetry in my life at Williams' shop.

I flatter myself that I achieved success as a mechanic but I must confess there was in my early life no indication of any mechanical aptitude. As a boy I could not saw straight nor drive a nail without endangering my thumb. When I decided a trade was better for my soul than bookkeeping, then for the first time in my life I did a little mechanical work. Our house had never had window screens. They were not in common use at that time. Wire covers, of which there was then an immense sale, were used to cover food on the table but flies and mosquitoes had free access to the rooms. Seeing a screened window one day I examined it carefully and decided I could make some for our house. I got from the sawmill some refuse strips from the edges of boards, from which, with some cotton netting, I made four rough window screens. I was proud of my achievement and felt that I deserved the praise my parents and their friends lavished on my ingenuity. I also, under the stimulus of their commendation, made a rough bookcase and cane-seated two chairs. This is all the mechanical work I ever did up to the time of my going to work as a carpenter's apprentice. Could I have been examined at that time by a modern vocational expert, I don't believe he would have suggested a machine shop as a suitable place for me, but I thank the fates that led me to Williams' not only for the material success that came to me, but even more for the thorough training of hands and brain my work there gave. My advice to all parents is to have their boys and girls taught to use their hands skillfully in some worth-while mechanical trade regardless of what they expect to do for a life work. My observation of friends and acquaintances, who have never had any manual education, is that they are handicapped seriously in some way or other, even though they seem utterly oblivious to it themselves.

CHAPTER V

WHEN the learning-a-trade part of my life began I stopped almost entirely my walks in the woods that had been for years my sole but delightful diversion. I could have resumed them when I got settled at Williams' but after I had been there for a few weeks I found another use for my Sundays in an investigation that seemed at first even more mystic than my hours of enchantment on the hills and shores.

I still kept up my acquaintance with George Phillips, whom I have mentioned before, and spent occasional evenings at his home. One evening it occurred to me to try again with him the table tipping and rapping that had scared me so thoroughly a few years before. I was now working with that occult force, electricity, and here was a possible chance to make some discoveries. I felt sure spirits could not scare an electrician and they might be of use to him in his work.

On July 16, 1872, we "had a spirit circle" at Phillips' house with "strong manifestations." These were at first entirely table tippings and rappings, from the merest ticks to loud knocks. Phillips and I sat at the table with our finger tips on its upper surface, and asked questions of the spirits, who instantly responded by three knocks or table tips for "yes" and two for "no."

The movements of the table varied greatly. Sometimes it rose gently from the floor with its top level and was lowered just as softly, and sometimes it jumped up quickly and was slammed down. More often it would be tipped up on two legs sometimes gently, sometimes forcibly and on several occasions when the table was tipped in this way, I sat on the high side and felt it as firm as if it were resting on the floor.

After a few of these sittings I decided there was nothing electric about the doings, but they seemed so supernatural, I accepted the "disembodied spirit" theory of their cause. I determined, however, from the start that I had no power to produce the phenomena. From or through Phillips alone they all came.

We were so interested in the wonderful occurrences that we had a sitting nearly every night the first week, some of them at my house, where they were quite as strong as at the other house. My parents and sisters witnessed them occasionally but at most of the seances, Phillips and I and another young man, John Raymond, afterwards mayor of Salem, were the sole participants and all three of us soon became firm believers in spiritualism. We read the spiritualist paper, *Banner of Light*. None of the physical manifestations at sittings described in the *Banner of Light* were more remarkable than ours, but from that paper we learned about slate writing, and at our next sitting, tried it. My old school slate, with a short piece of pencil on its upper surface was placed on Phillips' hand which he then reached under the table. Instantly the pencil began to write briskly with the dash of a fluent penman, and, when Phillips took the slate from under the table, there was unmistakable writing on it!

I had never been taught at school either to make observations or to take notes of occurrences, and my literary powers were practically nil. Boylike, I was sure I could never forget anything that interested me as much as did these sittings. For this reason many details of the phenomena were not noted in my diary. I have forgotten many of the minor occurrences but the principal ones are clear in my mind still. The slate writings that impressed themselves on me were "O. P.," "I am happy," "I was murdered," "Charley Chase is in the happy land."

The "O. P." with a free-hand circle around it came at almost every sitting. They were the initials of Oliver Phillips, our medium's father, who went west when George was a baby and never was heard from afterwards. There was a rumor that he had been murdered. The next two phrases I mention were supposedly from the spirit of the father. Charley Chase was a playmate who had gone out of our lives two or three years before. Besides these intelligible things many irregular and unmeaning scratches would be made on the slate at each trial.

We sometimes tried to make other things besides the dining table jump and rap. When we asked to have the raps come on a glass bookcase, or on the mop board, the spirits would always obey. One Sunday afternoon, we put our fingers on the air-tight stove in the sitting room. It jumped as vigorously as the table, but we never tried that again for the funnel pulled out and made a sooty mess.

Variations of these phenomena comprised the program of each sitting, until one evening in September John Raymond introduced a novelty. He began acting strangely, and announced that he was going into a trance under the control of a spirit. His arms and legs jerked convulsively; his eyes rolled and his features became alarmingly distorted. Then, after five or ten minutes of this preluding, he stood up with the air of a political orator and made a speech that lasted half an hour. At each sitting after that, John would be taken in the same way, and seemed to enjoy it very much. I don't remember what he said except that on one occasion, which I noted in my diary, he predicted a bloody religious war that was to break out in this country within a year which, it is hardly necessary for me to say, never happened.

I was skeptical about John's trances. I knew he had oratorical powers for I had often heard him spout when we were working together in the crockery store, and, although I wondered at his fluency of speech at our sittings, I never really believed he was controlled by any one but himself. Phillips was bored with John's performances for he wanted to give the whole show himself, being proud of the fact that only he had the power to make the table and slate do things.

But our spiriting did not continue long. My diary notes seven seances in July, seven in August, seven in September and two in October. The seance of August 25 is noted as "the best we have had." That of September 22 as "strong." But, on October 29, I wrote, "Very little, very queer." On November 23, "No manifestations, very strange." On December 1, 1872, "No manifestations." January 13, 1873, I note in my diary that I have written a "letter to the *Banner of Light* about the stopping of our physical manifestations." Then we evidently got discouraged and gave up the sittings.

Was this all some humbug of Phillips? I do not hesitate to say positively "No!" What I have recorded here happened often in bright daylight on a Sunday, or a holiday afternoon, under conditions that utterly precluded any fraud on the part of Phillips or any one else. And the fact that he lost his power to produce the phenomena completely at the end of about four months is evidence of his honesty, for, as I have said, he was very much puffed up with his occult and exclusive power, and when he found it was leaving him, he was very sad and did all he could to keep it. One afternoon when the table wouldn't tap or move, nor the pencil make the smallest scratch in spite of his earnest entreaties to the spirits, Phillips flopped down on his knees with his head in a chair, and wept and prayed for a long time, beseeching God to give him back his power. But it never came back and my diary notes no more sittings.

I consider this experience of mine as a piece of rare good luck. Although I have since tried several times to renew my acquaintance with the phenomena, I have not seen anything convincing of the kind except with Phillips, although for many years I was a member of the Society of Psychical Research. Had I not had this early experience, I should to-day, like most of my friends, have thought and spoken of spiritualistic manifestations as either frauds or illusions, and so have missed all knowledge of a marvelous force.

I have not for many years, however, believed these phenomena were caused by discarnate human spirits. My limited experience does not justify dogmatizing on this disputed subject but I am better satisfied with the explanation that Phillips and other mediums are endowed with the power to transform some subtle, bodily radiation into a mechanical force that produces the raps, movements, and slate writings as a steam engine changes heat into mechanical motion or a telegraph instrument transforms pulsations of electricity into the taps of the Morse code. I believe investigation on the basis of this hypothesis will give results but do not think the spirit theory can lead to anything of value. I am ready to adopt any other theory that better explains the facts and am certain that, whatever the explanation may be, we have in these phenomena evidence of a force, the nature of which is unknown to us.

Another thought: Mediums whose powers have been convincing to intelligent observers, have suddenly been caught in some bare-faced fraud. Here is an explanation. If Phillips had been ten years older he would probably have become famous in a short time as a professional medium, and, very likely, have built up a business from which he would have made a good living. Under such circumstances, when his powers began to fail, to keep his income he might have devised means which would have been as foolish as those of the exposed mediums. Like them his fraud would have been detected and his genuine past condemned as theirs have been.

About a year after my seances with George Phillips ended, I made another discovery that for years seemed to me as occult as the table tippings and slate writings. My hours of work at Williams' made it necessary for me to take early morning and late evening trains between Boston and Salem so that the shadow of my train on sunny days was always projected well out on the meadows.

One morning, sitting in the car dreamily looking out of the window as the train was running over the Lynn marshes, my eye caught a faint, elongated glow a little brighter than the sunlight on the grass, streaming out beyond the shadow of the car and marking the place where I was seated. I was startled. Was it a personal emanation? I changed my seat. The columnar halo followed me! I went to the platform at the end of the train. It was there, too. I leaned back so that the shadow of my head itself was thrown on the grass. The halo surely streamed from my head! I went back to my seat to see if any one else had the glow over his head. There was only one halo and it was over me!

The next Sunday afternoon I walked to Legg's Hill and found a place where my shadow was projected on the grass below. My halo was there, so faint that I could not distinguish it from the general sunlight unless I moved quite rapidly but, when I did, it was unmistakable. It was the same when I rode in a carriage or in the horse car with the sun in the right position.

The conviction grew that either I had a guardian angel permanently attached to me or that I was endowed with this mysterious thing to indicate that I was chosen for some great purpose. I told my mother about my halo. It didn't seem at all strange to her that her son was thus distinguished; it was quite what she would expect. I tried to make my friends see it as they rode with me in the car but their eyes were not sharp enough. A year or two later I told Graham Bell about the halo. He scoffed at it and said it was undoubtedly due to some defect in my eyes. That didn't shake my faith; my halo came triumphantly through all tests I submitted it to and for several years I felt distinguished by it above my fellow creatures.

But, alas, one day I ran across a description of the phenomenon in one of Thoreau's books and soon after found the same thing in Benvenuto Cellini's *Autobiography*, translated by John Addington Symonds. In Chapter X of *Walden*, Thoreau says:

> As I walked on the railroad causeway, I used to wonder at the halo of light around my shadow and would fain fancy myself one of the elect.

Thoreau learned later that every one had the halo, but Cellini died evidently thinking the halo was his especial favor from the gods. He wrote:

> Since that time [referring to a recent illness] till now an aureole of glory, marvelous to relate, has rested on my head. . . . This halo can be observed above my shadow in the morning, from the rising of the sun about two hours, and far better when the grass is drenched with dew. It is also visible at evening about sunset.

Soon after reading this I succeeded for the first time in getting others to see this delicate glow, but it was always above their own heads, not above mine. The explanation is simple. The glow is simply the reflection of sunlight. As you look toward the low sun over a body of slightly ruffled water, you see a shining path leading from you to the orb, caused by a myriad reflections of the sun's disk on the waves. My halo is the extension of the sun path on the other side of the observer caused by the much fainter reflections of the sunlight on the grass blades, showing brightest on wet grass.

Thus vanished my faith that I was a distinguished young man and nothing has happened since to renew it. When I found everybody had a halo I was glad I had not publicly boasted about mine. I had been somewhat awestricken by the thought that I was favored in this mystic way by the gods and sometimes I really tried to make myself worthy of their choice.

I can perhaps claim to have made a new observation regarding this reflection. As far as I have been able to ascertain, no one else has seen the delicate phenomenon as a narrow shaft of light extending above his shadow which to me is its most striking feature. It is not easy to see; none of my friends had ever noticed it until I called their attention to it and, even then, few were able to see the dainty shadow.

CHAPTER VI

MY notebook of this period of my life contains many recipes, one of which for "Pills to improve the voice" indicates that I was still interested in declaiming. Most of them, however, were for preparations useful in my work; lacquers, stains, bronzes, cements, solders, with all of which I experimented. A recipe for liquid-skin reminds me of the minor accidents we workmen were continually having. I never had anything more serious happen to me than a bad cut or the loss of a finger nail, which is rather remarkable, as my usual way of working at full speed made me forgetful of the imminence of cuts, wounds or bruises. Safety-first devices and warning cards were unknown then and so was industrial insurance. If we hurt ourselves we suffered the consequences. I must have been somewhat of a prig for I usually consoled a shopmate, when I was bandaging his wound, with the trite remark, "There's more blood shed in peace than in war." Getting metal chips into the eye was one of the worst accidents that could happen to us. We were continually taking things out of each other's eyes, generally using a looped bristle from our bench brush, an operation in which I became quite expert. An oculist would have been horrified at our methods but an accident had to be serious before a doctor was called in. I had one severe experience when a hot brass chip struck my eyeball and laid me up a day or two, and after that I wore goggles when doing any work that set the metal chips flying, although my fellow workmen scorned such things as effeminate.

My work on mechanisms operated by the electric current opened a new world to me with many tempting paths to explore. My Sunday hours in the woods were now devoted to more material matters than they had been a few years before, for I spent the time pondering on questions aroused by my work, to some of which I have never found answers. I jotted in my diary ideas that seemed important to me at the time. Here are a few of them that indicate I was thinking as well as working with my hands:

> Is red hot glass a conductor of electricity?
>
> What sort of a vibration is a hissing sound?
>
> Device to light kerosene lamps by electricity.
>
> Why do clouds that are heavier than air remain suspended? Is it an effect of electricity?
>
> Try an electric battery with a glass element in hydro-chloric acid.

An induction current may be caused by reflex action of ether.

Is permanent magnetism caused by spiral streams of ether in one direction or by a right and left spiral? The latter would explain why a magnet is neutral in its center.

Undulations of light can be refracted. Why not those of electricity?

Although horses, rum and tobacco had no adverse effect on my childhood, something in my life at Williams' shop proved I wasn't always so superior to my environment. During my first two years there I worked at a lathe and bench by the side of a young man who cursed and swore at the slightest provocation with an astonishing facility for unique combinations of "cuss-words," which he uttered with a wonderfully vigorous and perfect expression. I listened to him at first with disgust, soon with indifference but finally, whenever something went wrong in my work I found myself expressing my annoyance by an emphatic utterance of some of his striking expressions. All the men in the shop swore more or less but none of them was influenced by my benchmate as much as I was, perhaps because they didn't work as near him as I did. Perhaps, too, I was more easily contaminated because my love for expressive speech fixed my attention on the young man's elocu-

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tion. Those two years gave me a habit of swearing, when I was annoyed, that I have tried all my life to eradicate, but when anything is dug into a boy as deeply as this was into me, I don't believe it ever gets entirely rooted out. A few years ago I was sure I had conquered the silly habit, but one day when I was soldering a leak in a water pipe in a dark corner, I reached back and picked up a soldering iron by its hot end. Since then I haven't been so sure the habit is completely subjugated.

I had some unhappy days at Williams' when I tired of the close confinement or had an uninteresting job and could not invent a new way of doing it. In such moods, when I was walking up the street to the shop of a morning, the thought would come to me, how glad I should be to find the shop burned down. Occasionally, of a fine summer morning, outdoors seemed so attractive compared with the shop, I marched past the entrance, with my lunch box under my arm, to the Public Garden and spent most of the day, usually under a big cottonwood tree—still alive—south of the pond. I have never since enjoyed a vacation nor known brighter sun, bluer sky or sweeter air than on those wonderful days I played truant from my work. Later, on such days, my interest in steam engines drew me to the various railroad stations to examine the locomotives and note how they differed from those of the Eastern Railroad with which I was familiar. A single day off, however, satisfied me and sent me back to my work with renewed energy and interest, glad the shop was still there.

I was quite as much interested in steam as I was in electricity and in the dull intervals of Williams' business constructed for myself several steam engines and boilers, operating them over the gas jet at the shop or on the cookstove at home. From my interest in steam engines sprang the great Fore River Ship and Engine Company, which I established later in my life.

To vary my routine, sometimes of a morning on my way from Salem, I changed cars at Revere to the train running to East Boston. The ferry across the harbor and the unfamiliar streets leading from the wharf to the shop gave me the pleasure and stimulation of foreign travel. It brought me to my work an hour late, however, which was always deducted from my wages.

CHAPTER VII

AFTER about two years, my reputation as a rapid and accurate workman began to bear its most important fruit by bringing me into contact with men who had new electrical notions they wanted to have put into shape. The modern development of electrical machinery was just then beginning and many men were studying its possibilities. Williams' shop was a paradise for these men of visions and there were often two or three of them there feverishly superintending the construction of their machines, spurred on by visions of boundless wealth.

Although most of these inventors had an "angel" who paid their bills—rather grudgingly—they were always hard up and anxious to have their work done as cheaply and quickly as possible. My devices for speeding up machine construction were just what these men needed and by the first of the year 1874, my time was almost entirely devoted to the work they brought to Williams'.

But in spite of my hurry-up methods, I do not remember ever completing one of their machines quickly or cheaply enough to satisfy its inventor. No matter how big or complicated it was, he wanted it finished and ready to test a day or two after I started to build it. I never could become conceited about my rapidity when I was doing their work for I was never fast enough to suit their impatience. But I liked this kind of work for it was never tedious and if any suggestion for a small improvement on an invention came to me while I was working on it, its inventor was usually glad to have me build it into his machine.

But, notwithstanding our combined efforts, few of these things were practical and, after many such experiences, I found myself somewhat skeptical about electrical inventions, so many of those I had worked on having turned out utter failures. I also began to see that my inventive friends seldom knew what others had done along the lines they were working. I had bought an old copy of Davis' *Manual of Magnetism* and had found in the Public Library other illuminating books on electrical and mechanical subjects from which I learned that a little reading would save much time and money in working out an invention.

But the men with notions to work out were not always of the unsuccessful type. There were a few coming to the shop whose knowledge of things electrical was so broad and their ideas so practical that I profited greatly by my association with them. Chief among these was Moses G. Farmer, one of the leading practical electricians of that day, who usually came to Williams' to have his numerous inventions put into shape. His work was often assigned to me and my work with him was an important part of my electrical education. His inventions were not always successful. One day, when one of the machines I had made for him failed to work as well as he had expected, he said to me, "Watson, never use an electrical device if you can find a mechanical one that will do the work, for electricity is mighty uncertain stuff to work with." This was before the days of dynamos, when the only current available was from unreliable galvanic batteries. But something a good deal bigger was close at hand for which all this work was only preparation.

One day early in 1874 when I was hard at work for Mr. Farmer on his apparatus for exploding submarine mines by electricity and wondering what was coming next, there came rushing out of the office door and through the shop to my workbench a tall, slender, quick-motioned young man with a pale face, black side-whiskers and drooping mustache, big nose and high, sloping forehead crowned with bushy jet-black hair. It was Alexander Graham Bell, a young professor in Boston University, whom I then saw for the first time. He also was living in Salem, where he tutored the deaf child of Thomas Sanders, and came in to Boston practically every day.

He was bringing me two little instruments I had made during the intervals of my work for Mr. Farmer without knowing what they were for or to

THOMAS A. WATSON
1874

whom they belonged. They had not been made in accordance with his directions and he had impatiently broken down the rudimentary discipline of the shop by coming directly to me to have them altered.

To make my work on his apparatus more intelligent, Bell explained them to me at once. They were, he said, a transmitter and a receiver of his "harmonic telegraph," an invention of his which he expected would enable him, when the mechanism was perfected, to send six or eight telegraph messages over a single wire simultaneously without conflicting with one another so that one wire could do the work of six or more.

The principle on which his telegraph worked was the same sympathetic vibration which sets a piano-string or organ-reed vibrating when its own note is sounded near it. Bell's invention using, instead of the air, an intermittent current of electricity to carry the vibrations over a wire, could set a string or reed in motion a hundred or more miles away and consequently could be used for conveying telegraph messages.

His apparatus was very simple. The transmitter had an electro-magnet with a reed made of steel clock-spring mounted over it and an adjustable contact screw like that of an ordinary electric bell. The receiver had a similar magnet and spring reed but needed no contact screw.

The operation was also very simple. The reed of the transmitter, kept in vibration by a battery connected through the contact screw, interrupted the battery current the number of times per second that corresponded to the pitch of the reed. This intermittent current, passing through the telegraph wire to the distant receiver, set the reed of that receiver into vibration sympathetically if it was of the same pitch as the transmitter reed. If the two reeds were not of like pitch, the receiver would not respond to the current.

If six transmitters with their reeds tuned to six different pitches were all sending at once their intermittent currents through the magnets of six distant receivers with reeds tuned to the same pitches, each receiver would, theoretically, select from the mix-up its own set of vibrations and ignore all the rest.

When the apparatus was used as a telegraph each of the six operators would have a differently tuned transmitter to send his messages with, breaking up the current into the dots and dashes of the Morse code, and, if all six were sending messages at once over a single wire, the selective powers of the correspondingly tuned receivers were expected to separate the messages so they could be read by the receiving operators.

I made first for Bell one receiver and one transmitter both tuned to the same pitch. They worked so well when we tried them on a circuit in the attic of Williams' shop that Bell ordered six pairs of the instruments. But when they were finished and we tried to send several messages at once with them, they did not work as well as they theoretically ought for the receivers would not always pick out the right messages.

Bell was of course disappointed at this unexpected behavior of his telegraph but not in the least discouraged. He energetically continued his experimenting, keeping me busy for several months making and altering his instruments and helping him test them.

Part of this experimenting was on Bell's "autograph telegraph," an apparatus for telegraphing facsimile writing and pictures which was an important use he wanted to make of his harmonic telegraph when he got it perfected. As it was necessary to get accurate selective reception of the electric messages by the harmonic receivers before pictures could be transmitted, we spent most of our time on the harmonic work, but the perfection of his autograph system was constantly in Bell's mind.

We accomplished little of practical value in spite of our hard work, the chief result attained being to prove to Bell that the harmonic telegraph was not as simple as it seemed. They were most satisfactory months for me if not for Bell, for I profited greatly by my close association with him. No finer influence than Graham Bell ever came into my life. He was the first educated man I had ever known intimately and many of his ways delighted me. His punctilious courtesy to every one was a revelation. The books he carried in his bag lifted my reading to a higher plane. He introduced me to Tyndall, Helmholtz, Huxley and other scientists of whose writings I had been ignorant until then. He scolded me for dropping my algebra and bought me the latest book on the subject he could find.

But the best thing Bell did for me—spiritually—was to emphasize my love for the music of the speaking voice. He was himself a master of expressive speech. The tones of his voice seemed vividly to color his words. His clear, crisp articulation delighted me and made other men's speech seem uncouth. When he learned of my interest in speech tones he was surprised and pleased and gave me some of his father's books on elocution. He pointed out errors in my way of using my voice. All of which I keenly appreciated and practiced diligently on my poems when I went into the woods on my Sunday walks.

And his table manners were most interesting. Up to that time, the knife had been the principal implement for eating in my family and among my acquaintances. The only point of table etiquette that had ever been impressed on me was that the knife should be put into the mouth with its sharp edge towards the middle of the lips as otherwise there would be danger of widening the orifice painfully.

I was much embarrassed the first time I had supper with Bell at his boarding house, in trying to imitate his exclusive use of a fork in the conveyance of food. It was a new kind of fork, too. Those I had always used had two tines; this was like a spoon with three long slots in it. However, by careful observation and private practice, I soon conquered this leaky, inefficient implement and have never had much trouble with it since, although to this day I have a private preference for a spoon for many articles of food.

Bell had another fascination for me: he was a pianist, the first I had ever known. To play the piano had always seemed to me the peak of human accomplishment. It seemed so occult and inexplicable that I asked Bell one evening, when he was playing on his boarding-house piano, if it was necessary to hit the keys exactly in order to play a piece or would striking them anywhere in certain vicinities of the keyboard answer the purpose? My respect for the art was deepened when he said the precise key had to be struck every time. The possibility of my ever learning the art, which had been one of my secret aspirations, faded at this revelation of its unexpected difficulties.

CHAPTER VIII

BUT all this time there was another man struggling with the harmonic telegraph idea—Elisha Gray of Chicago. Bell and Gray had both applied for patents on it and their claims were in conflict in the Patent Office at Washington waiting for a decision. Meanwhile both were working hard to perfect the invention for practical use.

Gray was electrician for the Western Electric Company of Chicago, the largest manufacturer of electrical machinery in the country at that time. His shop had better tools and did finer work than Williams'. Whenever a piece of Western Electric machinery came into our shop for repairs, the beauty of its design and the quality of its workmanship made it an object of admiration to all of us, and made most of Williams' instruments look crude.

But in spite of Bell's hard study on his telegraph invention, my best workmanship and, perhaps, some small notions of my own that got built into the apparatus, we couldn't make it work rightly. When we had it rigged up in the attic, if we sent a message to our hypothetical Portland station in one corner of the room, Salem in another corner would get half of it and the other half would be scattered over the other New England stations distributed about the garret. Our struggles to harmonize the harmonic telegraph and make its receivers more sympathetic in their response to the vibrations we sent them were largely unavailing.

By spring, 1875, my faith in the harmonic telegraph had vanished and, at last, after months of hard work on it, Bell's magnificent courage began to flag. I knew he was losing his enthusiasm for now I seldom heard his favorite expression, "Watson, we are on the verge of a great discovery," which, uttered, as it always had been, in a tone of conviction, would spur me on to renewed exertions to get improved apparatus finished and ready to try.

But we need not have been discouraged, for the perfection of the harmonic telegraph we were struggling so hard to attain was really a matter of small importance.

I had not worked with Bell long before I found the harmonic telegraph was not his only new idea. His head seemed to be a teeming beehive out of which he would often let loose one of his favorite bees for my inspection. A dozen young and energetic workmen would have been needed to mechanize all his buzzing ideas. There was one of Bell's ideas that was easily queen of the hive. I have never forgotten the first time it stung me. Bell, being busy during the day, would often ask me to stay in Boston with him in the evening to help him test his apparatus when I had finished some of it. One evening when I had been working with him, trying some new feature in the discouraging harmonic telegraph, he said to me, perhaps, to cheer me up a little, "Watson, I've another idea, I haven't told you about, that I think will surprise you." I listened somewhat inattentively while I worked away at his instruments, my receptive powers hardly at their best, for those evenings I stayed in Boston to work meant an eighteen-hour day for me; but, when he went on to say in his usual convincing way that he had had an idea in his head for more than a year by which he was sure he would soon be able to *talk by telegraph*, his startling assertion banished my tired feeling and I don't remember that it ever came back.

Bell had a remarkable power for clear and terse explanation. The words he used in giving me the essence of his great idea have remained in my mind ever since.

"Watson," said he, "if I can get a mechanism which will make a current of electricity vary in its intensity, as the air varies in density when a sound is passing through it, I can telegraph any sound, even the sound of speech." He went on to describe a machine that he thought might do this. It was an apparatus with a multitude of tuned strings, reeds and other vibrating things, all of steel or iron combined with many magnets. It was as big, perhaps, as an upright piano. We discussed the possibility of constructing one, but nothing was ever done about it for Thomas Landers and Gardiner G. Hubbard, the two men who financially and otherwise were supporting Bell in his experiments, were urging him to perfect his telegraph, assuring him that then he would have money and time enough to play with his speech-by-telegraph vagary all he pleased. So we pegged away at the telegraph and dreamed about the other vastly more wonderful thing.

But the harder we worked on the harmonic telegraph the worse it acted. Although Bell did not realize it at the time, it was lucky for him his telegraph apparatus did not work any better, for had it been an easy success the coming of the telephone might have been delayed and, perhaps, have found its way into the world through some other brain. The superstitious might have said Bell's guardian angel was messing up his telegraph for Bell's ultimate benefit. The apparatus sometimes seemed to me to be possessed by something supernatural, but I never thought the supernatural being was strictly angelic when it operated so perversely.

But this spring of 1875 was the dark hour before a bright dawn coming for both of us. The date when Bell first conceived that splendid idea—a current of electricity thrown by a sound into undulations that are the mathematical equivalent of the air-waves made by that sound—is, of course, the most important day in the history of the telephone. For from that conception the science, the art and the present stupendous business organization of modern telephony have sprung.

Who can say, even Bell himself, when or where the first glimmer of that idea came to him? It is not likely that it flashed into his mind at once in its perfect form. Like most great ideas it was probably vague at first, growing through the years until it formulated itself in the full conception. I believe Bell's idea took its perfect and final form in the winter of 1874-75 in the dismal shop attic where we were working on his harmonic telegraph when he first began to doubt the practicability of that invention. I think he then used for the first time the words in which he described his conception of the fundamental principle of the speaking telephone, a description so perfect that it cannot be improved after fifty years of research.

Brantford, Ontario, the city where Bell lived with his parents when he first came to the United States, claims that he first conceived the idea of the telephone there. It may be so. Edinburgh, I have heard, makes the same claim and so do several places in Massachusetts—Boston, Salem, Newton. Brantford has set the world an example by erecting a fine monument to Bell's memory which might well be followed by every country in the wide world to honor the man and also as an expression of gratitude that into our world there come these mysteries we call

Ideas, some of which, like Bell's, mark epochs in human progress.

History gives us many illustrations of the transforming power of an idea, but Bell's conception of a speech-shaped electric current ranks among the most notable of them. The conception itself was the great thing and any mechanism embodying it, even the very first form that was discovered, is of minor importance. If Bell had never found the apparatus for which he was searching to produce his ideal current, his name should have been immortalized.

My realization of this has always made me very modest over my contributions to the art of telephony. I knew other young electricians who could have done my work with Bell as well as I did it, but there was only one Bell with his big idea. My principal value as his associate was, perhaps, that I hastened the development of his idea into a commercial success. Possibly by so doing, I averted the danger, rather imminent at times, of his losing much of his financial reward. Bell was a pure scientist; making money out of his idea never seemed to concern him particularly. But there were many ingenious minds hungry for profits, ready to seize for their own benefit any hints Bell might let drop. Had there been a delay of a year or two in the commercializing of Bell's conception, the history of the telephone business would probably have been very different from what it is.

Bell not only had the first conception of the electric-speaking telephone but he was also to realize his great idea in practical form. The date of that realization is next in importance to that of his fundamental conception. It was June 2, 1875, a day that stays in my mind as one of vivid contrasts—a black and white, gloom and sunshine, lean and fat, poverty and riches, sort of a day.

Bell and I had spent the day in Williams' attic, trying to make the harmonic telegraph behave itself. He had found that one reason why its messages got mixed up in transmission was inaccuracy in tuning the receiver reeds to match those of the transmitters. This was always his part of the job for he was a fine musician, while my sense of pitch was altogether too slight for such work.

The final tuning up before we tried to send messages had to be done when the instruments were connected with the battery and line wires. When tuning a receiver reed, Bell had the fortunate habit of pressing it against his ear which enabled him to hear in the magnet the whine of the intermittent current coming from the distant transmitter and, by changing the length of the receiver reed by a simple instrument I had designed, while holding it to his ear, he could make the two pitches conform.

On that hot June day we were in the attic hard at work experimenting with renewed enthusiasm over some improved piece of the apparatus. About the middle of the afternoon we were retuning the receiver reeds, Bell in one room pressing the reeds against his ear one by one as I sent him the intermittent current of the transmitters from the other room. One of my transmitter reeds stopped vibrating. I plucked it with my fingers to start it going. The contact point was evidently screwed too hard against the reed and I began to readjust the screw while continuing to pluck the reed when I was startled by a loud shout from Bell and out he rushed in great excitement to see what I was doing. What had happened was obvious. The too closely adjusted contact screw had prevented the battery current from being interrupted as the reed vibrated and, for that reason, the noisy whine of the intermittent current was not sent over the wire into the next room, but that little strip of magnetized steel I was plucking was generating by its vibration over the electromagnet, that splendid conception of Bell's—*a sound-shaped electric current.*

That delicate undulatory current, which at other times had been drowned out by the heavy intermittent current passing through the receiver Graham Bell had at his ear, had been converted by it into a very faint echo of the sound of the transmitter reed I had plucked. Probably nothing would have come from the circumstance if any other man than Bell had been listening at that moment but he with his mind prepared by his great conception instantly recognized the supreme importance of that faint sound. It told him his long-studied idea had at last found its mechanism for he knew he was hearing, for the first time in human history, the tones and overtones of a sound transmitted by electricity, and realized it was being done by some part of his telegraph apparatus. His shout and eager rush into my room was his reaction to that startling realization of his dream.

Plucking the reed of that transmitter was apparently a trifle. Steel reeds had probably been set into vibration in close proximity to electromagnets many times before, but never with such a momentous result as this plucking brought. The twang of that reed I plucked on June 2, 1875, marked the birth of one of the greatest modern inventions, for when the electrically carried ghost of that twang reached Bell's ear his teeming brain shaped the first electric speaking telephone the world had ever known. The sound of that twang has certainly been heard around the world and its vibration will never cease as long as man exists.

The derangement of that transmitter was accidental but the invention of the telephone was not an accident. It was an instance of the prepared mind solving a long studied problem by means of an unexpected result suddenly presented during work on a different line. In that way Bell's harmonic telegraph was a success not as a telegraph but as the means that led to a far greater thing.

We spent the rest of the afternoon and evening repeating the discovery with all the steel reeds and tuning forks we could find, and before we parted late that night Bell sketched for me the first electric speaking telephone, beseeching me to do my utmost to have it ready to try the next evening. And as I studied the sketch on my way to Salem on the midnight train, I felt sure I could do so.

That first telephone was a very simple mechanism consisting of a wooden frame on which was mounted one of Bell's harmonic receivers, a tightly stretched parchment drumhead to the center of which the free end of the receiver reed was fastened and a mouthpiece arranged to direct the voice against the other side of the drumhead. It was designed to force the reed to follow the vibrations of the voice and so generate voice-shaped electric undulations.

I might as well have stayed in Boston for I did not sleep much that night, but the next morning I got to the shop as early as the first train from Salem could carry me and rushed the work on the telephone with all the speed I could summon. I made every part of that first famous telephone with my own hands, but I must confess my prophetic powers, if I had any, were not in operation that day. Not for a moment did I realize what a tremendously important piece of work I was doing. No vision of the giant that new-born babe was to be in a few years came to me as I hurried to get it ready to talk. I am sorry I was too busy at lathe and bench to do any dreaming for it would make a pretty story if I could record that I foresaw the great things to come and was stimulated by them to extra exertions. But there was nothing of the kind; I rushed the work because I was mightily interested in the invention and wanted to hear it talk.

There were other things to think of, too. It occurred to me, while I was building the telephone, that we could not test it on the wire that ran between the two attic rooms, where we had operated the harmonic telegraph, for they were so near together we could hear each other through the air and couldn't tell whether the telephone was talking or not. So after I finished the telephone, I hid it in my clothes locker, got some wire from the office and ran it from one of the attic rooms two flights down the elevator to my workbench. When all was ready for the trial, I went to supper.

Bell came into the shop soon after I returned. The men were gone and we had the building to ourselves. Bell inspected with great interest his telephone, which he then saw for the first time, and pronounced it quite right.

Then, in great excitement, we adjusted it carefully and connected it with a battery into the circuit I had run from the attic to my bench. To listen with, we connected in one of the harmonic receivers at the attic end of the wire. The new telephone was on my bench. Then came its first trial. Bell listened in the attic with the receiver reed pressed against his ear, just as he did when he was tuning them, while I talked into the telephone on my bench.

But alas, shout my loudest, Bell could not hear the faintest sound. We changed places, I listened in the attic while Bell talked into the telephone downstairs. Then, I could unmistakably hear the tones of his voice and almost catch a word now and then. I rushed downstairs and told him what I had heard. He was, of course, disappointed at the meager result of this important experiment and so was I, for in spite of my skepticism regarding new inventions, the transmission of the sound of the vibrating reeds the day before had been so perfect that I had been feeling sure the new telephone would talk fluently.

But Bell had to be satisfied with what I told him I had heard which, slight as it was, indicated he was on the right track. We tried every way we could think of to make the telephone talk better that night but soon the parchment of its drumhead became softened by our breath and the reed breaking away from it put the telephone out of commission until repairs had been made. But we spent the rest of the night discussing possible improvements in its design and construction, thereby beginning the research work on the telephone that has gone on unceasingly to the present day in ever increasing volume and complexity. At that time the work didn't absorb the entire time of two men. To-day thousands of research workers are employed in the laboratories of the American Telephone and Telegraph Company doing the same work Bell and I began on that evening in June, 1875—trying to make it easier to talk by telephone.

I didn't feel such bitter disappointment over the poor results of this first test as Bell did for I had learned to expect unforeseen complications in the first trials of a mechanism embodying a new idea. I have certainly reason to be pleased with the events of that exciting month of June, 1875, for not only did I construct Bell's first telephone but I also ran the first telephone circuit and heard the first vocal sound ever transmitted by electricity. I have never been particularly proud about the latter distinction for I have always been aware that the principal reason why I heard Bell through the telephone when he couldn't hear me was the vast superiority of his resonant voice over mine, which was then rather feeble in spite of my declamations in the woods, but probably my sensitive ears had something to do with it. However, helped by Bell's suggestions and the strenuous use of my vocal organs in the experiments on the telephone which immediately followed this first trial, my voice soon became so much stronger that Bell could hear me as well as I could hear him.

The building, 109 Court Street, Boston, in which these events occurred is still in existence (1926). It is now used for vaudeville and moving pictures and a false front has been built on its lower stories, entirely changing its appearance. The location of my workbench on the third floor, where I made the first telephone and Bell transmitted to me in the attic the first sound ever sent over a telephone by electricity, is now in the flies of the theater, high up above the stage at its left. The attic, the scene of the discovery of the telephone, is unchanged except that the workbenches and partitions are removed. The two double pointed-arch windows in the mansard roof are still there. Between them there was formerly a partition which divided the front attic into two rooms.

I was sitting at the window nearest Hanover Street when I plucked the reed of that harmonic telegraph transmitter and made the twang that has never stopped vibrating. Bell was at the other window when he heard the faint sound in his receiver which was the birth-cry of the telephone. The building has been marked by a bronze tablet on one of the pillars of the false front of the theater which reads:

HERE THE TELEPHONE WAS BORN, JUNE 2ND, 1875.
THE BOSTONIAN SOCIETY AND THE NEW ENGLAND
TELEPHONE AND TELEGRAPH COMPANY
PLACED THIS TABLET MARCH 10TH, 1916.

During alterations to the building in 1925 this tablet was removed, but it was later put up again under the box-office window. On December 15, 1925, the tablet was rededicated, and on that occasion I told the story of Bell's work in the attic to an audience of telephone men.

CHAPTER IX

THE first telephone was used only a few weeks for the experimenting before it was superseded by modifications that talked better and did not get out of order so easily. Bell continued his work on the harmonic and autograph telegraphs for a while but his interest in them soon died out and he devoted his time more and more to devising and testing improved forms of his telephone, in all of which work I took part, constructing his apparatus and trying it with him.

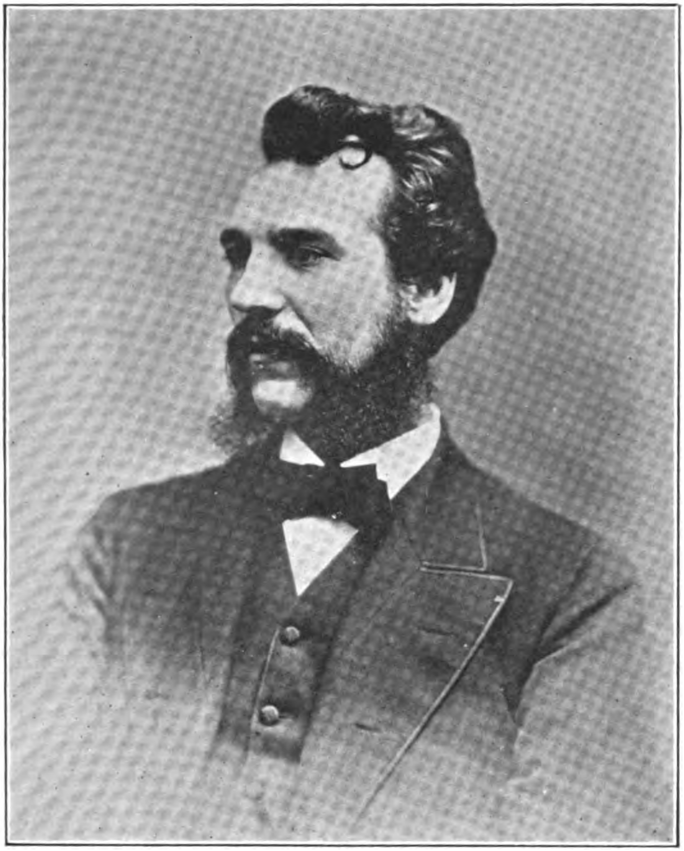
When his experimenting on the speaking telephone had fairly begun, Bell decided that, until his patents were secured, it was well to keep his apparatus more out of sight than was possible at Williams' shop. He now gave up his teaching in Salem and moved in January, 1876, into Boston. He hired, for four dollars a week, two rooms in the attic of a boarding house at 5 Exeter Place, about half a mile from the shop. He slept in the room fronting on Exeter Place. The other room looking out on the backs of buildings on Hayward Place I fitted up for him as a laboratory, running a wire to test the telephones on between the two rooms. After that, practically all his experiments for the next two years until the telephone was ready for public use, were carried on there.

No. 5 Exeter Place soon became as familiar to me as Williams' shop for whenever I finished for Bell the construction of some modification of the telephone, I carried it to the new laboratory, to spend the night testing it and discussing further improvements, getting a few hours' sleep in Bell's bed towards morning. But the work on the telephone during the latter half of 1875 progressed slowly as Bell was sick for several weeks at his father's house in Ontario and, when he recovered, was obliged to spend most of his time for several months preparing his specifications for his telephone patent.

The slow improvement of the telephone during the first year after its birth was due not only to these interruptions but also to the fact that, being such an absolutely new thing, Bell's work on it was quite like cutting a path through a dense jungle never trod by man.

Bell filed his application for his telephone patent on February 14, 1876, and so novel was the invention that his patent was granted almost immediately. I remember Bell's joy when he brought me the news that his telephone patent had been allowed almost as he had written it. It was allowed on his birthday, March 3, and was issued to him on March 7, 1876.

This patent, the specifications for which were al-



Alexander Graham Bell
1876

most entirely written by Professor Bell, is a monumental evidence not only of the clearness of his great conception of a speech-shaped electric current but also of his comprehension of the only practical means for producing such a current. So fully did it cover the subject that it has stood like a rock against the assaults of a host of claimants that sprang up as soon as the telephone became a tempting financial success and it is to-day the foundation of the art of telephony.

It was not until March 10, 1876, that the telephone had been sufficiently developed to transmit a whole sentence intelligibly. This was done by a modification of Bell's invention that we called a battery transmitter because it could be used only to transmit and not to receive the sound. In his first telephone the electric speech-undulations were magneto-electric, the voice being the sole source of power. But from the first Bell knew he could produce stronger undulations as perfect in form by a more complicated telephone so designed that the voice varied the resistance of a circuit through a galvanic battery, and some of his earliest experiments included work on such a battery transmitter.

It was during one of his experiments on this kind of a telephone that the first sentence was transmitted and understood. I had made for Bell a new transmitter in which a wire, attached to a diaphragm, touched acidulated water contained in a metal cup, both included in a circuit through the battery and the receiving telephone. The depth of the wire in the acid and consequently the resistance of the circuit was varied as the voice made the diaphragm vibrate, which made the galvanic current undulate in speech form.

I carried the transmitter when finished to Exeter Place on the evening of March 10, 1876, intending to spend the night with Bell testing it. Neither of us had the least idea that we were about to try the best transmitter that had yet been devised. We filled its cup with diluted sulphuric acid and connected it to the battery and to the wire running between the two rooms. When all was ready I went into Bell's bedroom and stood by the bureau with my ear at the receiving telephone. Almost at once I was astonished to hear Bell's voice coming from it distinctly saying, "Mr. Watson, come here, I want you!" He had no receiving telephone at his end of the wire so I couldn't answer him, but as the tone of his voice indicated he needed help, I rushed down the hall into his room and found he had upset the acid of a battery over his clothes. He forgot the accident in his joy over the success of the new transmitter when I told him how plainly I had heard his words, and his joy was increased when he went to the other end of the wire and heard how distinctly my voice came through.

The transmission of this first sentence was so impressive that I noted it in my diary with some other phrases that were transmitted between the two rooms that night, one of which was "God save the Queen." The little book is now preserved in the historical library of the American Telephone and Telegraph Company in New York.

This important event in the history of the telephone might possibly have been more impressive if Bell had transmitted a more poetic sentence. Not expecting such a sudden advance in the talking power of his telephone that evening, however, he had not prepared a suitable sentiment for the occasion. His shout for help on that night of March 10, 1876, doesn't make as pretty a story as did the first sentence, "What hath God wrought!", which Morse sent over his new telegraph from Washington to Baltimore about thirty years before, but it was an emergency call—therefore typical of the great service the telephone was to render to mankind. What could have been more appropriate! I am of course satisfied with the pioneer sentence, and with the fact that I heard it. The event is commemorated by a bronze tablet inserted in the wall of the commercial building on the corner of Exeter Place and Harrison Avenue Extension, Boston, that now occupies the site of Bell's boarding house of 1876, which reads:

> HERE ALEXANDER GRAHAM BELL TRANSMITTED TO THOMAS AUGUSTUS WATSON THE FIRST COMPLETE AND INTELLIGIBLE SENTENCE BY TELEPHONE, MARCH 10, 1876. THE BOSTONIAN SOCIETY AND THE NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY PLACED THIS TABLET MARCH 10, 1916.

That this improvement in the talking powers of the telephone came so soon after the date of Bell's telephone patent is a mere coincidence due to the fact that, when Bell finished his work on his patent specification, his experimenting was vigorously resumed and quickly brought results.

Getting that famous first sentence through the telephone seemed to exorcise some of the tantalizing imps that always pester the babyhood of a new invention as infantile diseases do a human baby, and a few weeks later the telephone was talking so fluently you did not have to repeat what you said more than half a dozen times before almost any one at the other end could understand you perfectly, provided the sentences were simple and carefully spoken.

At this time, early in 1876, there was but one outdoor telephone line in the world. It was the iron wire about half a mile long, grounded at each end, that connected the Exeter Place laboratory with Williams' shop. This No. 12 galvanized wire was run for us by some of Williams' men over the housetops very soon after work in the new laboratory was started. It was the first outdoor telephone wire ever put up and it played an extremely important part in the development of the invention. It was in constant use until the laboratory was abandoned in 1877. There were no trolley car or electric light systems to send their rattling current-noises into our wire and the only other electric circuits in constant use were the telegraph wires, the currents in which, being comparatively weak and easily recognized as the dots and dashes of the Morse code, did not trouble us.

This early silence in a telephone circuit gave an opportunity for listening to stray electric currents that cannot easily be had to-day. I used to spend hours at night in the laboratory listening to the many strange noises in the telephone and speculating as to their cause. One of the most common sounds was a snap, followed by a grating sound that lasted two or three seconds before it faded into silence, and another was like the chirping of a bird. My theory at the time was that the currents causing these sounds came from explosions on the sun or that they were signals from another planet. They were mystic enough to suggest the latter explanation but I never detected any regularity in them that might indicate they were intelligible signals. They were seldom loud enough to interfere with the use of the telephone on a short line.

A few years later these delicate sounds could no longer be heard for they were completely drowned out when electric light and power dynamos began to operate. I don't believe any one has ever studied these noises on a grounded telephone line since that time, for they could not be so studied to-day unless a wire were run in some wilderness far from an electric light or power station.

These currents were probably from the same source as the static that afflicts the modern radio, and the difference in their sound may have been due to the fact that they were not amplified in the telephone then as static is now in a radio receiver. I, perhaps, may claim to be the first person who ever listened to static currents.

Another interesting fact we early noticed was that the telephone talked better nights and Sundays than it did during the busy hours of week days, although our laboratory, being on a side street, was always fairly quiet. We sometimes tested a new telephone for the first time late at night or on Sunday and were elated at the excellent result, but trying the same instrument the next day, we were disappointed to find that what we had supposed to be an improvement was not so at all. We soon discovered that the reason why the talking in the busy daytime was much poorer than at other times was that the air of the quietest city room during the day is vibrating with a complex of sounds blended into a loud hum to which we are so accustomed that we don't ordinarily notice it but which is loud enough to obscure the articulation of a telephone as feeble as our early ones were. At night or on Sunday, the diminution of city sounds gave the telephone a much better chance to be heard.

CHAPTER X

EARLY in the summer of 1876 Bell decided to exhibit his telephone at the Centennial Exposition at Philadelphia. The original telephone of June, 1875, was then obsolete for we had several different forms of the instrument superior in every way to the first one. For the exhibition I constructed three or four pairs of the best of these, and they were not the crude affairs knocked together in a hurry such as we had been using for our laboratory experiments, for I put into them my finest workmanship, using bronze instead of wood and polishing them like mirrors. But I couldn't see, when I tested them, that they talked any better than the rough ones we had used before. Bell delayed his decision to exhibit so long that when I had his telephones ready to ship, he could not get space in the electrical department of the exhibition and was obliged to place his apparatus in the educational section. There, where no one would think of looking for electrical instruments, his exhibit might have been overlooked by the judges if the Emperor, Dom Pedro of Brazil, by recognizing the young teacher of the deaf from Boston, had not called it to the attention of Professor Joseph Henry and Sir William Thomson, the chairmen of the committees of judges on electrical and related instruments.

Those nicely finished telephones talked very well indeed for those distinguished men. I was as proud as Bell himself when I read Sir William's report in which, after giving an account of the various tests he and his colleagues made with them, he went on to say:

> I need hardly say I was astonished and delighted, so were the others who witnessed the experiment and verified with their own ears the electric transmission of speech. This, perhaps the greatest marvel hitherto achieved by the electric telegraph, has been obtained by appliances of quite a homespun and rudimentary character.

I have never quite forgiven Sir William for that last sentence. I wonder what he would have said if he had made his tests with the telephones Bell and I had been working with up to that time.

A little while later I made an especially fine pair of telephones for Professor Bell to present to Sir William Thomson. In transit to England they became slightly out of adjustment, and it is interesting to note that so new was the art of telephony, when Sir William, the greatest living scientist, tried them in his English laboratory he could not make them work, although they had talked particularly well when Bell and I tested them before sending them to that distinguished physicist.

I was a little cut up about this reference to my best workmanship for I had expected favorable mention for my handicraft. But I was philosophical about it. I had noticed before that the fellow who did the hard work never got the praise, as the mason said to the architect when the cathedral was dedicated.

However, Gardiner G. Hubbard, one of Bell's backers and afterwards his father-in-law, helped me to recover my self-esteem. That summer he offered me a tenth interest in Bell's patents if I would give up my job at Williams' and devote my whole time to Bell's work. I was pleased at such evidence of his and Bell's appreciation of my work but not enthusiastic over his proposition, another indication that my power to look into the future and say "which grain will grow and which will not," was quite lacking. I had a good job at Williams', earning journeymen's wages—three dollars a day—and putting money into the savings bank every month, and I was in line for the foremanship of the establishment. It was quite two weeks before I could decide to accept Mr. Hubbard's offer. When I did, he appointed the first Monday in September for me to meet him at the Crawford House on Court Street and sign my contract, but I almost missed it even then, as well as all other earthly appointments.

That summer had been very hot and I had found a cooler recreation for my Sundays than my usual walks in the woods by hiring a rowboat from the Beverly Bridge drawtender and rowing down to a small island at the mouth of Salem harbor where, anchoring, I spent the day alone, fishing a little, reading and dreaming a great deal more, and rowing back in the evening.

The day before my appointed meeting with Mr. Hubbard I carried out this program but, the wind blowing a gale from the northwest when I started for home, my light muscles could make no headway against it. I do not remember being frightened, but I ought to have been for the water was very rough and it looked as if I might be blown out to sea.

A few days before I had acquired an interesting bit of knowledge about a path pursued by a body pushed by two forces acting in different directions. The thought in my mind when I was struggling with the oars was what a fine illustration of such a path this was that my boat was traveling. While I was rowing it to the west and the wind was blowing it to the southeast I was trying to decide whether its resultant path would hit Salem Neck, Marblehead or Cape Cod. I reached after a long struggle the very tip of Marblehead and landed on the rocks with a badly smashed boat. This was lucky for had I missed that point my little boat would have soon swamped in the open sea. The only evil effects from my adventure were very sore muscles the next day and a bill to pay for damage to the boat.

I met Mr. Hubbard at the appointed time and signed the contract by which I agreed to devote my time to the development of the harmonic telegraph and the speaking telephone and as compensation for my services was to receive one-tenth interest in all of Bell's patents besides the same wages that I had been receiving from Charles Williams, Jr.

CHAPTER XI

PROFESSOR BELL and his partners must have been well satisfied with my work when they made a contract with me apparently so favorable but, as matters turned out, one of my patents on telephone apparatus (there were about sixty in all) was worth to the Company all I got from this contract, so it was as good for Bell and his associates as it was for me. The contract was for only half my time, as Williams did not want me to drop his work entirely, so for a few weeks after signing the contract I worked for him half of each day. Up to that time I had been living in Salem with my father and mother, going back and forth on the train every day, but now it became necessary for me to live in Boston. I hated to leave my mother, but the old house in the corner of the stable yard I left without regret. Fortunately the other room in the attic of Bell's boarding house had just been vacated. I suspect its occupant, Henry Davies, an actor at the Boston Theater, had been driven out by the noise Bell and I made with our experimenting. Taking this for my bedroom gave us the whole floor, which was a further safeguard against curiosity of outsiders. In passing, I will note for the benefit of the superstitious that the laboratory room was numbered 13, which in this case at least did not bring bad luck.

Then began a period of intense work on the telephone. Although the harmonic and autograph telegraphs were not entirely laid aside, we concentrated almost entirely on speech transmission. We systematized the experiments by varying each part of the telephone in turn in every possible way, while keeping the other parts constant. The parts were few—the electromagnet and its coils, the diaphragm, and the mouthpiece, with either a battery or a permanent steel magnet to excite the electromagnet—but the work was difficult. In varying the diaphragm, for instance, it was necessary, in order to find its most efficient diameter and thickness, to construct telephones with all sizes of diaphragms from one made of boiler iron three feet in diameter and half an inch thick, down to a minute affair I made from the internal bones and drum of a real human ear that Dr. Clarence Blake, the well-known aurist, gave to Bell —of course, after his patient had finished with it. They all worked, even the real ear telephone, which was, however, the poorest of the lot. We finally decided on a diaphragm of iron of the same size and thickness as is used to-day. Then we varied the magnet in every way we could think of. In our earlier experiments we used an electromagnet excited by a battery, for that enabled us to vary the power of the magnet by varying the number of battery cells. We tried such magnets with long cores and short cores, hard cores and soft cores, solid cores and wire cores, fat cores and thin cores, with coils of many sizes, shapes and resistances. It was tedious and often discouraging work, but although most of our results were negative, we slowly forged ahead, and about six weeks after I signed the contract Bell decided his baby had grown big enough to go out doors and prattle over a real telegraph line, instead of gurgling between two rooms.

Bell did something that summer that nearly deprived me of the honor of participating in an important telephone event. He spent his vacation at his father's home in Brantford, Ontario, and took two of the Centennial telephones up there with him. One day while there, he got the use of a telegraph line and connected a telephone transmitter at one station and a telephone receiver at a distant station, but as the instruments he had enabled him to talk in one direction only, the answers were made by Morse telegraphing. This was an important bit of history but I am glad to say it was reserved to me to participate in the first actual conversation by telephone ever carried on between two stations on an outdoor wire.

We got permission from the Walworth Manufacturing Company to try the telephones on their telegraph wire, about two miles long, running from their office in Kilby Street, Boston, to their factory in

East Cambridge, and on October 9 I went to Cambridge with one of the best working telephones we had, Bell going to the Kilby Street office with its mate. These were telephones that would both transmit and receive. I don't think Bell was as nervous about the test as I was, for his experiment that summer in Canada had given him more confidence in the talking powers of the telephone on a real wire, but, as it was a new experience for me, I was much excited while I was disconnecting the telegraph instruments, connecting the telephone and doing the other things needed to get ready for the test. When I had the telephone accurately adjusted and all the connections complete, in intense expectation I put my ear to it and listened for Bell's voice. Not a sound could I hear although I knew Bell must be shouting. I shouted into my instrument and listened again. Nothing but black, dismal silence! I looked over the connections, readjusted the telephone, then listened and called again. Silence still! Could it be that although the telephone would work all right between two rooms it would not do so under regular telegraph conditions? I knew we were using the weakest current ever used for any practical purpose and that it was also of a very high intensity, for we had talked successfully through a circuit made up of a dozen persons clasping hands—a very great resistance. Was it possible that the glass insulators that were right for the telegraph current would not hold our much more intense current to the wire? Did a little leak to the ground at every support so that none of the electric undulations from Bell's voice got across the Charles River to where I was?

These were some of my thoughts while I was manipulating things in every possible way, trying to make the telephone talk. But it was useless, the thing was obstinately dumb. I had about decided to disconnect the telephone, reinstate the telegraph instruments and telegraph to Bell that although his telephone might work as a speaking tube, I was afraid it could never compete with the telegraph, when something occurred to me that I should have thought of before. Was there another telegraph relay in some other part of the factory connected into the wire we were using? If there was I knew it would wipe out our delicate voice-generated undulations.

The watchman had been standing by during all this trouble watching me as if he thought I must be crazy, shouting into a brass contraption and expecting some one over in Boston to hear me! I asked him if there was another telegraph instrument in the factory? He didn't know. Would he show me where the wire entered the building? After some demur he consented, and with the watchman at my heels, I traced the wire to where it entered a room, evidently the foreman's office. While he was unlocking the door, I was thinking that if there wasn't any relay in that room, I ought to apply to Williams the next day for my old job, but, when his lantern flashed into the room, I saw the relay I had suspected. I cut it out with a piece of wire across its binding posts, rushed downstairs, followed at a much slower pace by the watchman, and listened at the telephone.

It was no longer dumb! More loudly and distinctly than I ever had heard it talk between two rooms, Bell's voice was vibrating from it, shouting "Ahoy! Ahoy!" "Are you there?" "Do you hear me?" "What's the matter?" I could even hear that he was getting hoarse for he had been shouting all the time I had been hunting over the factory building. I ahoyed back and I could hear his sigh of relief as he asked me, "Where have you been all this time?" in a tone that indicated he thought I'd been loafing.

Then began the first "long distance" telephone conversation the world has ever known. We recorded it word for word. The croakers made us do that. The common attitude toward any new thing is apt to be pessimistic for the average man thinks that what hasn't been done, can't be done. It was so with the telephone. It seemed a toy to most persons. Some of Bell's friends, although they had heard the thing talk at the laboratory, were doubtful as to its practical value, and one of them of a scientific turn of mind had told me that he didn't see how the telephone could be accurate enough for practical use for every spoken word has many delicate vibrations to be converted into electric waves by the telephone and if some of them get lost the message cannot be intelligible. To confute these pessimists Bell had arranged with me before I went out to Cambridge that, if we succeeded in talking at all, I was to write down all I said to him through the telephone and all I heard him say, and he would do the same at his end of the wire. Then by putting the two records side by side he could prove to the doubters that the telephone could talk straight. So this historical first "long distance" conversation was preserved, and published in the next morning's *Boston Advertiser*.

After we had written down enough to satisfy the critics, we continued our conversation, without recording it, in huge delight at being able to talk fluently over a real wire two miles long. I let the watchman listen, but even then I think he felt it was some humbug. His relief at getting rid of me was evident when he let me out of the building towards morning to walk proudly back to Boston with the telephone, a bundle of wire and my tools under my arm wrapped in a newspaper.

Ever since I had known Bell he had had a habit of celebrating his successful experiments by what he called a war dance and I had got so expert at it that I could do it quite as well as he could. That night, when he got back to the laboratory, we forgot there were other people in the house and had a rejoicing that nearly resulted in a catastrophe, for the next morning, after a sleepless night, as I started down the stairs to go to Williams' to build some more telephones, I saw our landlady waiting for me at her door with an acid expression on her face. My conscience was troubling me and I felt something disagreeable was about to happen. My pretense of great haste did not work for she stopped me and said in an unpleasant voice, "I don't know what you fellows are doing up in that attic but if you don't stop making so much noise nights and keeping my lodgers awake, you'll have to quit them rooms." I couldn't say much to calm her. I assured her we would be more careful although for the life of me I didn't see how we could get along with any less noise than we had been making. I couldn't blame her finding fault. She wasn't at all scientific in her tastes and we were not prompt with our rent.

CHAPTER XII

THE publicity the newspapers gave our experiments brought all sorts of people to the laboratory to hear the telephone talk. Among our callers were many well-known scientists who were immensely interested in the telephone. My old electrical mentor, Moses G. Farmer, came one day to see the latest improvements, and after I had shown them to him, we sat down and had a chat over old times. He had tears in his eyes as he told me that, when he first read a description of Bell's telephone and realized what a simple thing it was, he was not able to sleep for a week, he was so mad with himself for not discovering the thing years before. "Watson," he said, "that thing has flaunted itself in my face a dozen times during the last ten years and every time I was too blind to see it." Many others could say the same. They didn't see it because they hadn't in their minds the idea of a speech-formed electric current. Bell had that idea, and so the first time it flaunted itself in his face he knew what it meant.

Two of our regular visitors at the laboratory interested me greatly. They were young Japanese pupils of Bells—very polite, deferential, quiet, keen men. They always talked Japanese through the telephone and were hugely delighted as they shouted back and forth. I have often wondered what they said in their earnest discussions of the invention. It also interested me to see how many people were embarrassed when they used the telephone for the first time. One day a prominent lawyer tried the instruments with me. When he heard my voice in the telephone making some simple remark he could only answer after a long embarrassed pause, "Rig a jig, jig, and away we go."

Men of quite another stamp from those I have mentioned came occasionally. One day Mr. Hubbard received a letter from a man who wrote that he could put him on the track of a secret that would enable us to talk any distance without a wire. This interested Mr. Hubbard and he made an appointment for the man to meet me at the laboratory. At the appointed time a stout, unkempt man made his appearance. He glanced at the telephones lying around the benches but didn't take the least interest in them. He told me the telephone was already a back number and if we would hire him he would show us how to telephone any distance without apparatus or wires. He looked as sane as most of the inventors I had worked with and I became interested. When I asked him what experiments he had made, he told me in a matter-of-fact tone that two prominent New York men, whose names he knew but whom he had never seen, had managed surreptitiously to get his brain so connected with their circuit that they could talk with him at any hour of the day or night wherever he was and make all sorts of fiendish suggestions —even of murder. He didn't know just how they did it but their whole apparatus was inside his head and if I wanted to find out their secret I must take off the top of his skull and study the mechanism at work. For fifteen dollars a week, he said he would place himself entirely at my service to do whatever I pleased with him. Long before he finished his tale, I knew I was dealing with a crazy man. I didn't dare to turn down his proposition too abruptly for fear he might go on a rampage in that lonely attic so I excused myself from starting to dissect him at once on the ground of a pressing engagement and he went away promising to come again the next day. He didn't come and the next time I heard of him he was in an insane asylum. Within the next year or two several men whose form of insanity made them hear voices which they attributed to the machinations of enemies, called at the laboratory or wrote to us for help, attracted by Bell's supposedly occult invention.

November, 1876, was one of the most discouraging periods in the development of the telephone I can remember. It would talk moderately well over a short line but the apparatus was delicate and complicated and it didn't talk distinctly enough for practical use. But we had both used up our ideas and couldn't think of anything else to make the telephone work better. It seemed for weeks as if it had got stuck in the mud and nothing we could do would pull it out. I spent days in the Public Library in search of some suggestion that would lift us out of the slough. One day in a fit of desperation, remembering my experience with the "spirits" and being still of the belief that it really was spirits that did the table tipping and slate writing, I decided to consult a medium (without Bell's knowledge) and see if there was any help to be got from that source. I read the advertisements of mediums in the newspapers, which were numerous at that time, and selected one by a woman whose announcement seemed convincing, and arranged with her for a seance. But she gave me such rubbish I never afterwards tried to get the spirits to give the telephone a boost.

I went back to the books of the Public Library as a more certain source of inspiration. One dreary day in November, when Bell was away and my depression at its deepest, I ran across something there in a book on the telegraph that started our experimental machinery going again. It was a description of a quick-acting magnet used in the Hughes Printing Telegraph, quite similar in principle to some we had already used but more delicately constructed. The word—quick-acting—struck me at once for that was the first essential for a telephone magnet. It wasn't many minutes before I was back at the laboratory rummaging in a big box of scraps for the materials to construct a magnet like the one of which I had been reading. I found part of what I wanted there and then rushed down to Williams' for the rest of the stuff I needed. In an hour or two I had the new magnet ready. There was nothing really new about it. It was a permanent magnet made up of four hardened steel horseshoe plates bolted together, with a small soft iron core, to carry the coils, clamped to each pole of the magnet. When I finished it, it was a simple matter to mount it with the diaphragm and mouthpiece of an old telephone, and it was ready to test. To my great joy the thing talked so much better than any other telephone we had tried up to that time, with either electro or permanent magnets, that from that moment all telephones requiring electromagnets and batteries went into the discard.

This occurrence illustrates the elusiveness of a new invention. We had used permanent magnets in the telephone experiments for months before this. Such telephones would talk without a battery but not as well as telephones with the electric magnets charged by a battery, so, as the latter were more convenient to experiment with, we had continued up to this time to use them almost exclusively in our struggle to perfect the telephone. But now we were brought up standing by the fact that we had got as far as we could in that direction. The thing that started us going again at full speed was a switchback to an old experiment but using permanent magnets of greater strength and with shorter coils of finer wire. Combining this new magnet with the improvements that had been made during 1876 in the other parts of the telephone, gave the entire machine an uplift, pulled us out of the slough of despond we were wallowing in and started us going again in a line that had not yet been exhausted.

This event is what Mr. Hubbard referred to when he wrote me January 20, 1877, as follows:

> MR. T. A. WATSON,
> DEAR SIR:
>
> I am very much pleased with the working of the instruments without battery and have no doubt that if you can succeed in making them work as well all the time as they do a portion of the time, and provide a call, your work is done and you will then begin to reap your reward.
>
> It far exceeds anything else you have done, and has all the qualities necessary for success, i.e., cheapness in first cost, perfect simplicity and almost entire freedom from need of repairs.
>
> I hope that now you are so near success that you will persevere and let nothing divert you from this work.
>
> Please let me hear from you occasionally.
>
> I am, yours very truly,
> (Signed) GARDINER G. HUBBARD

Now, we had the telephones so simplified and talking so well that we began to think it was time to put some of them into practical use. But before doing that we made some more long distance experiments on telegraph wires. One successful test was between Boston and Salem on November 26, 1876, and another, not so successful, between Boston and North Conway on the wires of the Eastern Railroad on December 3 of that year.

I went on a Saturday to North Conway with all sorts of apparatus we wanted to try on such a long line. On the next day, when the wires were not in use by the railroad, I, with Bell in Boston, made the test. We could hear each other over that wire 140 miles long, but the telegraph line was in such bad shape with its high resistance and rusty joints that the talking was unsatisfactory to both of us, although the others, who were invited to witness the test, were much impressed. I think I had a bit of prophetic vision during that Sunday afternoon for it was borne in on me very forcibly that, before we could talk practically over long lines many improvements in the circuits must be made and, as it turned out, years of hard work had to be done on long distance circuits before it was possible to talk over such a long one as we used that day. Hard-drawn copper wire, twisted metallic circuits, loading coils, and many other things that are necessities for long distance talking had not been even thought of up to the time of our North Conway experiment. But we were not particularly discouraged with the poor working of that long line for we knew there was plenty of use for the telephone on shorter lines.

The North Conway incident is vivid in my mind to-day, and not entirely because of the telephone experiment, but because it gave me my first sight of mountains. Those I saw on that winter day were to me like a glimpse into heaven, or, into some mystic other-world I had dreamed of. Most of the time I was in North Conway I spent gazing in wonder at the great white shapes reaching far up into the sky and taking me along with them. I was sorry when the time came for me to go to the railroad station Sunday afternoon to connect up the telephone apparatus and talk with Bell and his friends in Boston.

That vision of snowy mountains made a lasting impression on me. Up to that time the telephone had filled my life completely, but after that day in North Conway the telephone shrank a little and let me see more important things beyond it. My walks in the woods had been less frequent during the two years I had been so completely absorbed in Bell's inventions and my poems quite neglected, but the sight of those mountains made me long for my old enchanted wanderings and, one night in the laboratory, while I was waiting for Bell to return from Cambridge where he was now spending many of his evenings at Mr. Hubbard's house, I memorized

"Thanatopsis" as the nearest thing I could find in my books to fit my mountain mood.

One day I gave Bell an enthusiastic account of the North Conway mountains but he was not impressed and said they were hills compared with the mountains of Switzerland. I then and there decided if there were in that country any mountains more wonderful than those of New Hampshire I must see them. Up to that time my chief ambition had been to get money enough to buy a house for my mother to live in, but Bell's description of the Swiss scenery and some books I found in the Public Library about that country made me also dream of the day when I should go to Switzerland.

All these exploits with the telephone, of course, got into the papers and brought a demand for telephones for commercial use. For some weeks we had had a wire running over the housetops from the laboratory to Williams' shop and another running to an office on Pearl Street, where the time signal from the Cambridge Observatory ended, so that at night, when the signal wire was not in use, we could connect up a circuit to Cambridge for our experiments. But these were purely experimental wires. In April, 1877, the first commercial wire was run from Williams' shop to his house in Somerville, a distance of about three miles. I installed the telephones on it. The inauguration of this line was a great event. Reporters were there and Professor Bell and I took part in the ceremonies. The circumstance connected with it that lingers most plainly in my mind is the luncheon Mrs. Williams gave us in honor of the event. This first of the formal openings of telephone lines was on Wednesday, April 4, 1877.

CHAPTER XIII

BUT all this experimenting and traveling about was expensive and the financial problem was getting more and more troublesome. Thomas Sanders of Haverhill and Gardiner G. Hubbard of Cambridge, the two men who were paying for all this, getting impatient for some returns, had offered to the Western Union Telegraph Company all Bell's telephone and harmonic telegraph patents for one hundred thousand dollars. But that Company evidently had no faith in the future of the telephone for they refused to buy the patents and wouldn't even make an offer for them. I was quite excited while these negotiations were going on and much disappointed when the president of the Telegraph Company finally and somewhat contemptuously turned down our offer. There was reason for my excitement for I should have received about ten thousand dollars as my share, and I also expected a position with the Telegraph Company as superintendent of their telephone business. But their rejection of Hubbard's offer was another piece of good fortune for us all. Two years later those same patents could not have been bought for twenty-five million dollars.

But before that happy time came there were many difficulties to be conquered. Professor Bell had a special trouble all to himself, early in 1877—he had fallen in love, wanted to get married and didn't have money enough. He had been living all this time on his salary from the Boston University where he taught to normal classes his father's system of "Visible Speech," by which the deaf could learn to articulate.

He had private pupils, too, in this art, one of whom was the deaf son of Thomas Sanders of Haverhill, Massachusetts, with whose mother in Salem Bell lived when I first began to work with him. Some of his earliest experiments on his harmonic telegraph were carried on in the Sanders house and are commemorated by a bronze tablet on the Y.M.C.A. building now occupying the site of the house.

It was through his work for the deaf that Mr. Bell met Miss Mabel Hubbard, the daughter of Gardiner G. Hubbard. She was entirely deaf as a result of scarlet fever in her childhood, but she had become a proficient lip reader before Mr. Bell met her. He gave her a few lessons in voice culture to help her make her voice more pleasant, but she never was his pupil in the proper sense of the term as has so often been stated. It was she with whom Professor Bell had fallen in love.

I hadn't been in love since the time I was ten years old and had forgotten what an upsetting malady it could be until I observed its effect at this time on the professor. He was quite incapacitated for work much of the time during the autumn and winter of 1876, spending many evenings at Mr. Hubbard's home when I thought he should have been working in his laboratory.

Miss Hubbard occasionally came to the laboratory with her mother or sister, so I became quite well acquainted with her. She was a charming girl and I didn't wonder Bell fell in love with her. She could paint very well. One day Bell told me she had painted his portrait and that it was soon to be sent to the laboratory. When it came it was a picture in oils of a sedate owl. I could appreciate the joke, for Bell's habit of working nights had changed my usual hours of sleep which, since I had worked for a living, had been from 9 P.M. to 5:30 A.M., and it had been hard for me to adapt my working hours to Bell's, who was never ready for work until noon and didn't care to go to bed until morning. The picture of the owl hung on the wall of the laboratory during all the experimenting on the telephone until Bell married the artist.

The important question with Bell was, where could he get the money that would enable him to marry? But his guardian angel was still looking after him, for at that critical time a demand sprang up for lectures by him on the telephone and the money he received for so doing helped to tide him over financially. Nowadays, when a telephone is as commonplace as a door knob, it is hard to realize how intense the public interest in it was when it was new. There were in 1877, fortunately for Bell, thousands of people glad to pay fifty cents each to hear him tell about his invention and to hear the telephone talk. I don't believe any new invention to-day could stir the public so deeply as the telephone did then, surfeited as we have been with the many wonderful things that have since been invented.

These lectures are an important incident in the business history of the telephone because the money received for them obviated the necessity of selling telephones outright instead of leasing them, the policy which Mr. Hubbard afterwards adopted when their commercial use began. Leasing the telephones kept them under our control, making it easier for us, later, to get the capital necessary to start telephone exchanges all over the country, from which have come the universal service of the present day. Mrs. Hubbard favored Bell's suit for her daughter's hand and, realizing that lack of money stood in the way of his marriage, was, at this time, earnestly advocating the plan of constructing telephones by the thousands, imperfect as they were, and selling them outright. Fortunately for the future of the business, the returns from the lectures obviated this necessity. Had it not been for the lectures, Mrs. Hubbard would undoubtedly have carried her point.

Bell's first lecture was given gratuitously to the Essex Institute of Salem, Massachusetts. It created so much favorable comment that Bell decided to repeat it for his own benefit, doing so a fortnight later to an audience that again filled the hall. The net proceeds of his second lecture were eighty-five dollars, the first money the telephone ever earned for its inventor. And that infatuated young man squandered it all on a pretty little silver model of the box telephone which he gave to his girl—a bit of extravagance of which I didn't approve.

At the close of Bell's second lecture in Salem one of my old schoolmates, Henry M. Batchelder, telephoned from the hall in Salem an account of the lecture to a reporter of the *Boston Globe* who was with me at the laboratory on Exeter Place. This was the first telephonic newspaper dispatch. The reporter, not being used to the telephone, had difficulty in understanding the message so I took it, repeating it aloud while he wrote it down.

The delight of the Essex Institute over the success of Bell's lecture and experiments is shown by the resolutions they immediately adopted, one copy of which they sent to Professor Bell and another to me. These resolutions began as follows:

Resolved, That we tender our cordial thanks to Professor Alexander Graham Bell, and to his associate, Mr. Thomas Watson of Salem, for the wonderful and profoundly interesting experiments so successfully performed by them at Lyceum Hall on the evening of the 12th instant; and to the Atlantic and Pacific Telegraph Company, who generously permitted the use of their wires between Salem and Boston; and to Miss Anastasia L. Malloy, who operated the telegraph on that evening, for their assistance.

Another paragraph of these resolutions read as follows:

Resolved, That we deem it a signal honor to have been privileged to witness the first public operation of this wonderful instrument, at a meeting, a report of the proceedings of which was sent abroad as *the first public message by the telephone.*

Mr. Bell made some changes in his copy, characteristically omitting a paragraph of personal commendation, and let the newspapers have the resolutions in the amended form.

CHAPTER XIV

THE Salem lectures were followed by one in Providence, Rhode Island, to a much larger audience. Then requests poured in on Bell. One letter, asking for a lecture in Boston, was signed by fifteen notable men, among whom were Henry W. Longfellow, Oliver Wendell Holmes and Charles W. Eliot. In response to this, Bell gave three lectures on his invention at Music Hall, Boston, to large audiences, and after that three lectures at Chickering Hall, New York, and others in most of the large cities of New England. They were all given in the spring and summer of 1877. They interfered with our laboratory work, but the use of the telephone in connection with the lectures was an important help in its development as a practical working instrument.

I played an important part in Bell's lectures although I was always invisible to his audiences, being stationed every evening at the distant end of a telegraph wire connecting with the hall, having in my charge apparatus to generate the various telephonic phenomena Bell needed to illustrate his lectures. I had at my end of the line one of our loudest telephones especially adapted for the purpose, an electric organ on the principal of Bell's harmonic telegraph, a cornet player and sometimes a small brass band. But I was the star illustrator of Bell's lectures. My function was to prove to the audiences that the telephone could really talk, for which my two years of shouting into telephones of all sizes and shapes had fitted me admirably as it had developed in me a vocal power approximating that of a steam organ in a circus parade. I also had to do something else of importance for Bell's audiences, called by courtesy, singing.

Professor Bell had by his side on the stage a telephone of the big box variety we used at that time, and three or four others of the same type were suspended about the hall, all connected by means of a hired telegraph wire with the place where I was stationed, from five to twenty-five miles away. During the first part of his lecture Bell gave his audience the commonplace parts of the show, organ playing, cornet music, brass band, etc., and then came the thrillers of the evening—my shouts and songs. I shouted such sentences as, "Good evening," "How do you do?" "What do you think of the telephone?", which the audience could hear, although the words issued from the mouthpiece rather badly blurred by the defective talking powers of the telephones of that date. Then I would sing the only songs I knew. They were, "Hold the Fort," "Pull for the Shore" (I got these from Moody and Sankey who had just come to this country), "Yankee

Doodle," "Auld Lang Syne," and a sentimental song I had learned somewhere called, "Do Not Trust Him, Gentle Lady." My singing was always a hit. The telephone obscured its defects and gave it a mystic touch. After each of my songs I would listen at my telephone for further directions from the lecturer and always felt the thrill of the artist when I heard the applause that showed me how much the audience appreciated my efforts. I was usually encored to the limit of my repertory.

In making preparations for the first New York lecture, I incidentally discovered the need of a sound-proof booth and invented, on the spur of the moment, something that supplied that want very well, but it never occurred to me to patent it. It happened thus: Bell thought he would like to astonish his New York audiences by having his lecture illustrations sent from Boston instead of over the usual short wire. To determine whether it was practicable, he made arrangements to test the telephone a few days before the first New York lecture on one of the wires of the Atlantic and Pacific Telegraph Company.

We were to have the wire the night of April 2-3, 1877. Bell was at the New York end and I in the laboratory in Boston which had a wire connecting with the telegraph office. Having vividly in my mind the strained relations still existing with our landlady, and realizing the power of my voice when I really let it go, as I knew I should have to that night, I cast about for some device to deaden the noise. Time was short and appliances scarce, so the best I could do was to take the blankets off our beds and arrange them in a loose tunnel on the floor, with the telephone tied up in one end and a barrel hoop in the other end to facilitate my access to the mouthpiece.

Thus equipped, I awaited the signal from New York on the telegraph relay announcing that Bell was ready. It came soon after midnight. Then I connected the telephone, crawled into the blankets, and shouted and listened for an hour or two. It didn't work very well. I could hear Bell's voice but it was so blurred I couldn't understand him and he evidently had the same difficulty in hearing me. It was a hot, smothery experience and I was glad when Bell decided that the talking over such a long line wasn't good enough for his New York lectures, for the prospect of doing my part of a lecture shrouded in blankets wasn't alluring. However, Bell and I were the first who ever tried to talk between Boston and New York. My soundproof booth was a perfect success, as far as muffling the noise was concerned, for I found by inquiry next day that no one in the house had heard the row I made, not even the poor fellow who occupied the room immediately below the laboratory. Later inventors improved the booth, making it more comfortable for the public to enter but not a bit more soundproof.

One of Bell's New York lectures looms in my memory on account of a novel experience I had one evening at my end of the wire. After hearing me sing, the manager of the lectures decided that, while I might satisfy a Boston congregation, I would never do for a New York audience, so he engaged a professional singer with a strong baritone voice to do the singing part of the program. Being much better acquainted with the vagaries of the telephone than the manager was, I had strong doubts about the wisdom of this change in the cast of the performance. I didn't make any objections for I didn't want to be accused of professional jealousy, and I knew my repertory would be on the spot if the new singer wasn't a success.

I was stationed that night at a little telegraph office in New Brunswick, New Jersey, and I, and the rest of the appliances of that end of a lecture, went down in the afternoon to get things ready. My rival was there and I showed him what to do. He certainly had a magnificent voice, but I couldn't induce him to crowd his lips into the mouthpiece of the telephone in the way I had found necessary to get results at the other end of the wire. He was handicapped for the telephone lecture business by being musical for he didn't like the sound of his voice all jammed up in that way. That had never troubled me. I had noticed that the tighter I jammed my lips into the mouthpiece, the better my singing sounded to me. However, he promised to do just what I wanted when it came to the actual work of the evening, so I went to supper.

When I returned to the telegraph office just before eight o'clock, I found to my dismay that the young woman operator had invited six of her girl friends to witness the interesting proceedings. It hadn't troubled me in the least to talk or sing to a great audience, provided, of course, it was a few miles away, but when I saw those girls, the complacency with which I had been contemplating the probable failure of my rival's singing was changed to painful apprehension. I realized that, if he wasn't successful, a bashful young man would have a hard experience for he would be obliged to sing before those giggling girls. This world would be a happier place to live in if we all tried to help our fellow men succeed, as I tried that night, when Bell called for the first song, to make my fine singer achieve a lyrical triumph on the metropolitan stage. But he was still afraid of the mouthpiece and so he sang that song for the benefit of the girls and not for Chickering Hall. I listened with a heavy heart for Bell's voice when the song was finished. The expected blow fell promptly. In his delightful platform tones, Bell uttered the words I had foreboded, "Mr. Watson, the audience could not hear that song; won't you please sing?" I braced myself with the thought that Bell's first New York audience, made skeptical by their failure to hear the song, might be thinking cynical things about my beloved leader and his telephone, so I turned my back on those girls and made the telephone rattle with the stirring strains of "Hold the Fort" as it never had before. Then I listened again. The audience was applauding me vigorously! When it stopped, Bell's voice came with a note of triumph, saying, "Mr. Watson, the audience heard that perfectly and calls for an encore." I sang through my entire repertory and began again on "Hold the Fort" before they were satisfied. The "suppositious Mr. Watson," as the newspapers called me then, had to do all the singing at Bell's subsequent lectures. Nobody else ever had a chance at the job; one experience was enough for Bell. My baritone had a queer expression on his face while I was working on those songs. When I finished he said, "Is that what you wanted me to do?" "Yes," I replied, "that was what I tried to get you to do this afternoon." "Well," he said as he went towards the door, "I couldn't do that and I'm mighty glad I can't." He collected his fee that next day, but I never got anything extra for my songs that saved the day.

The lectures did not take me away altogether from the commercial part of telephone work. In May, 1877, two days after Bell's last lecture in New York, I went with Mr. Hubbard to Altoona, Pennsylvania, and installed two sets of telephones on a line belonging to the Pennsylvania Railroad, undoubtedly the first use of the telephone by a railroad.

The recollection is burned into my memory of another lecture that wasn't such a triumph over difficulties. In Bell's lectures we always had another trouble to contend with besides the rusty-jointed telegraph wires we used, which was the telegraph operators connecting in during the lectures their highest resistance relays, which, they had found, responded to some of the heavier electric effects I sent to the hall. Bell lectured in Lawrence, Massachusetts, one evening in May, and I prepared to furnish him with the usual program from our laboratory in Boston. I tested the wire the Telegraph Company assigned us in the afternoon and found that it worked fairly well, but in the evening during the lecture every operator on the line evidently plugged his relay into that wire and, do my best, I couldn't get a sound through to the lecture hall.

The local newspapers of the place where Bell lectured usually sent a reporter to my end of the wire to write up the occurrences there. Here is the report of such an envoy which appeared in the Lawrence paper the morning after Bell's lecture:

Our Mr. Fisher returned this morning. He says that Watson, the organist, and himself occupied the laboratory, sitting in their shirt sleeves with their collars off. Watson shouted his lungs into the telephone mouthpiece, "Hoy! Hoy! Hoy!" and receiving no response inquired of Fisher if he would be pardoned for a little Hamburg edging on his language. Mr. Fisher endeavored to transmit to his Lawrence townsmen the tune of "Federal Street" played on the cornet, but the air was not distinguishable here. About 10 P.M. Watson discovered the "Northern Lights" and found his wires alive with lightning, which was not included in the original scheme of the telephone. He says the loose electricity abroad in the world was too much for him.

The next morning the *Lawrence American* published the first verses ever written about the telephone, under the title "Waiting for Watson." Here are some of the stanzas:

To the great hall we strayed,
Fairly our fee we paid,
Seven hundred there delayed,
But, where was Watson?

* * *

Oh, how our ears we strained,
How our hopes waxed and waned,
Patience to dregs we drained,
Yes, we did, Watson!

* * *

Give but one lusty groan,
For bread we'll take a stone,
Ring your old telephone!
  Ring, brother Watson!

* * *

Or, by the unseen powers,
Hope in our bosom sours,
No telephone in ours—
  "Please, Mr. Watson."

Fred Gower, a young newspaper man of Providence, Rhode Island, was business manager of Bell's lectures. He introduced a novel feature in the last of them of which he was very proud—a dual lecture with my illustrations sent from a central point to two cities at once, Bell speaking in one city and Gower giving the same talk in the other city. My last appearance in the lectures was at one of these dualities. That night Bell lectured at New Haven, Gower gave the same talk in Hartford and I was at Middletown, Connecticut, with my apparatus, which of course included those songs. These double affairs were not always successful because the two men did not always talk about the same thing at the same time. At the New Haven-Hartford lecture they were so far apart that my program got badly mixed. The next morning when I met Gower he was quite vexed and accused me of shouting "How do you do?" when he wanted me to sing "Hold the Fort," and Bell said I made it very awkward for him when he wanted me to give him the trombone solo, by singing "Do Not Trust Him, Gentle Lady!" Gower said I did it on purpose, and Bell looked at me quizzically, but it wasn't so, I was too fond of Bell to play such a joke on him. Anyway, I am the first one who ever addressed two audiences at the same time.

This artistic interlude in my telephone work ended in the early summer. Besides raising some money for Professor Bell the lectures had stirred up a great commercial demand for telephones and I had to go back to the shop to hurry up their construction.

On July 11, 1877, Professor Bell married Miss Hubbard. Eddy Wilson and I went to the wedding and wore white gloves for the first time in our lives. We didn't know that at such occasions there was always a room for the men to dress in and as we were ashamed to wear our gloves in the horse car, we put them on behind a tree in front of the house before we went in. The bridal couple went to England on their honeymoon, Bell taking with him some up-to-date telephones to start the business over there.

Gower arranged to continue the lectures on the telephone on a large scale. A few months before Mr. Hubbard had given him an exclusive contract to lease telephones in New England but, being dissatisfied with the way Gower had handled the business, wanted to break the contract. Knowing how fascinated Gower was with lecturing, I suggested to

Mr. Hubbard that he offer Gower a contract for the exclusive use of the telephone for lecture purposes all over the United States in exchange for his New England contract. Hubbard did so, Gower accepted the proposition gladly and organized a series of lecture tours to cover the entire country. He soon gave it up for it wasn't a success after Bell and I left the platform. The public, of course, preferred Bell as a speaker and I have always felt that the singing did not maintain the standard I had set for it.

Gower and I made one notable experiment, the first trial of telephones on a submarine cable. During Bell's lectures, Gower had often urged such a trial for he was sure that, with very high resistance coils, the box telephone of the lecture type could talk across the Atlantic. Bell was not at all hopeful of the success of such an experiment but agreed with Gower to try it with him as soon as he reached England on his honeymoon. In the late summer of 1877, soon after Bell sailed for England, when Gower was discussing with me the changes he wanted made in the telephones for the submarine trial with Bell, I suggested that we try the instruments on a shorter cable first. He agreed and we got permission to use the direct United States cable from Rye Beach, New Hampshire, to Halifax, Nova Scotia, 550 miles long. Gower went to Halifax about the first of September with the special telephone I made for the trial, and on the appointed night I went to Rye Beach with its counterpart. We had a midnight trial but not the faintest sound could be heard at either end. Gower came back crestfallen but he evidently accepted the result as final for he never attempted the trial with Bell on the longer cable.

After Gower gave up the lectures he went to England where Bell was having a hard time trying to start the telephone business. Gower did not help him there. On the contrary, he made some modifications of Bell's telephone, called it the Gower-Bell telephone, got some moneyed men interested in it, sold his apparatus in opposition to Bell's and made a fortune out of it. Bell, through mismanagement of others, got little or nothing from his English patents and came home some eighteen months later discouraged and disgusted with his treatment in England. Gower afterwards married Lillian Nordica, the singer, but they lived together only a short time. The last scene in his life before the curtain dropped, showed a balloon with Gower alone in it, low down over the English Channel near the French coast. To a fisherman's hail, "Where are you bound?" Gower replied, "To London." Then he drifted into the fog and no trace of him or his balloon was ever found.

CHAPTER XV

A LITTLE before Professor Bell's departure for England in August, 1877, I dismantled the laboratory at 5 Exeter Place as it was too small for the research work now required. I retained for a few months my bedroom in the attic that had been the scene of many of Bell's struggles, discouragements and successes, but all my experimenting on the telephone and its auxiliary appliances now had to be done at Williams' shop where the manufacture of the apparatus was well under way.

With surprising forethought, when I dismantled the laboratory I took down the wire that connected it with Bell's bedroom, wrapped it up carefully and labeled it as follows:

This wire connected Room No. 13 with Room No. 15, at 5 Exeter Place, and is the wire that was used in all the experiments, by which the telephone was developed, from the fall of 1875 to the summer of 1877, at which latter time the telephone had been perfected for practical use. Taken down July 8th, 1877.

(Signed) T. A. WATSON

I kept it in my possession—in my safe deposit vault, when I attained that financial eminence—until 1914 when I turned it over with its original label to John J. Carty, chief engineer of the American Telephone and Telegraph Company. It is now one of the treasures of the Bell System Historical Museum.

Only a few fragments of the first telephone I made for Professor Bell on June 3, 1875, were preserved. In the experiments that followed that date, to save expense, we used parts of the earlier instruments over and over again until most of them were worn out or lost. When I broke up the laboratory I rescued the few parts that remained. They were later used in the suits over Bell's patents and are now in the custody of the National Museum at Washington, D. C.

While I was helping Bell with his lectures, I started the manufacture of telephones. Early in 1877 I gave Williams his first order, which was for twenty-five box telephones and fifty of the hand form. Up to this time I had made with my own hands practically all the telephones we needed, but that was no longer possible for, as they were now wanted in so much larger quantities, my time was occupied in supervising their construction, trying to improve them and reduce their cost.

The first thing I had to do after lectures stopped was to remedy some of the defects in the telephones that their use in the lectures had revealed. The first telephones put into commercial use, while the lectures were going on, were of the large box form developed for lecture purposes, in which loudness was more important than distinctness. It was an enormous affair compared with the telephones of to-day. Although Bell and I could talk through them readily, as soon as a few of them got into the hands of the public I found that people not used to the telephone had difficulty in understanding what was said. This big box telephone received loudly enough to be heard in the next room but its articulation was blurred by a booming overtone. Believing that the cause of this booming was some defect in the diaphragm, I tried numberless variations of that part of the instrument to see if I could eliminate the defect, but without success. I experimented on diaphragms for more than a month before it occurred to me that the booming might be due to the shape of the mouthpiece and of the cavity in the wooden block to which the diaphragm was fastened. One night I went to bed discouraged by the failure of my last idea for an improved diaphragm and almost ready to believe that the indistinctness of telephone talking could not be overcome, but the next morning the thought that the trouble was caused by the shape of the mouthpiece and its cavity came to me at the fertile moment of awakening. I rushed down to the shop and fitted up a telephone with a much smaller mouthpiece and with a very shallow cavity in front of the diaphragm. When I tested it I had a war dance all to myself for the booming blur that obscured the telephone's articulation had vanished. This was a big step forward, for the telephone no longer required an expert to use it.

But, although this improved the telephone, it brought me face to face with another difficulty—the calling apparatus. We had been calling the attention of the distant station by loud shouting into the mouthpiece or by tapping the diaphragm through the mouthpiece with the end of a lead pencil. With the lecture form of telephone the shout or the pencil thump could be heard all over a quiet house and even in a city office it was loud enough to call any one who was near the telephone. But making the telephone more distinct reduced its loudness so that neither thump nor shout could then be used as a call. Then I was obliged to turn my attention to inventing a practical calling apparatus for the telephone was useless without it. My first device was an improvement on the lead pencil. I rigged up a little metal hammer inside the box with a knob on the front so arranged that, when the knob was punched, the hammer inside flew up and struck the diaphragm at its side, where it could not be damaged. This caused a fairly loud thump to issue from the telephone at the other end of the line. This, known as "Watson's Thumper," was the first calling apparatus devised for use with the telephone. Twenty or thirty telephones were put into use with this hammer attachment. But it wasn't satisfactory, for something that would make a louder noise with less exertion was needed, and going back into the dark ages of a year or so before, I took parts of the abandoned harmonic telegraph and rigged them up as a call. In this device, moving a lever to and fro snapped a spring which in its vibration made and broke the primary circuit of an induction coil, inducing in its secondary coil an intermittent current that, passing through the telephone at the distant station, caused a howl in it loud enough to arouse the house. "Watson's Buzzer" was the name that got attached to my second device for calling. Many buzzers were made and sent out but the users didn't like the harsh screech it made. A bell that would ring without a battery was needed and I went to work to make one that would answer the purpose. The generating part of it was easy for I took it from a magneto-electric shocking machine in which the electric current was produced by revolving two coils over the poles of a strong, permanent magnet. This worked very well but the bell-ringing mechanism was much more troublesome. It had to be a polarized bell for the current was alternating and the first bell I made was adapted from a polarized telegraph relay. It worked all right in the shop so I made and sent out several hundred of them, but soon complaints began to pour in from the agents reciting their woes with the bell which, they said, often failed to respond to the frantic crankings of the man who wanted you. It was months before I devised a reliable bell which, as General John J. Carty, vice-president of the American Telephone and Telegraph Company, told me recently, has never been improved upon in principle. That polarized ringer I devised early in 1878 does to-day practically all the world's telephone calling.

Although I patented my call bell in several countries it never got my name attached to it. We gave Williams permission to make and sell them to our agents, who, impressed by the long, narrow, black walnut box in which the mechanism was placed, promptly christened them "Williams' Coffins," an honor I never disputed with him.

But the defective jingler wasn't the only trouble with this machine. At first I used a two-button switch on it which was thrown by hand to one button to put the telephone on the line, and thrown to the other button to put the bell back into the circuit. But the average user would often forget to throw the bell back after using the telephone, and then he couldn't be called. I tried several devices to remedy this trouble and finally designed the automatic switch operated by the weight of the telephone. This straightened out the switch matter for it now merely required that the user should hang up his telephone when he finished using it. This the public learned to do quite well after a year or two.

This automatic switch is used to-day and is indispensable. Although I invented it, the patent didn't issue to me, for our agent in New York, Hilborne L. Roosevelt, was working on the same idea and when we submitted the question of priority to arbitrators to decide which of us invented it first, they found that Roosevelt antedated me about half an hour. If I had not been busy that day studying a host of other troubles that needed fixing all at once, the automatic switch patent would have been issued to me instead of to Roosevelt. However, he was fair about it and divided royalties with me on the foreign patents.

While this experimenting with the calling apparatus was going on I changed the form of the box telephone. The big lecture box telephone was a costly, bulky affair. In it the iron cores that carried the coils were attached to the ends of the permanent magnets. By shifting these cores to the sides of the magnet I was able to reduce the size of the box to about one-quarter of what it had been. It simplified the instrument so much that Williams could turn them out more rapidly and at less cost. This was the final improvement ever made in the box magneto telephone and was used until superseded by a battery transmitter with a hand telephone as a receiver.

At first we used a single box telephone at a station, talking and listening at the same orifice. But shifting from ear to mouth was bothersome and we soon adopted the plan of installing two telephones at each station—a box telephone fastened to the wall by the side of the call bell and a small portable telephone used as a receiver and held at the ear all the time one was speaking. Bell had devised this portable or hand telephone early in 1877 but as it didn't talk loudly enough to be used in the lectures, it was laid aside and our principal attention given to the box form. When it became necessary to use two telephones at a station, I revived the portable or hand form and put it into shape for easy manufacture, using first a wooden container but soon superseding that by the hard rubber handle which is used, with slight changes in its shape, to the present day.

Adopting this hand telephone as a receiver brought another trouble. The conducting wires inside the flexible cord we had to use with it were continually breaking. This would stop all communication and, as the break didn't show on the outside of the cord, the cause of the trouble was not apparent. It was months before this aggravating trifle was remedied. One of our ingenious agents, Thomas B. Doolittle of Bridgeport, Connecticut, improved the flexible cord and after that it gave us less trouble.

Being for many months practically the only worker besides Bell in the unexplored field of telephony, it was easy for me to invent and patent many devices useful in the new art. I took out some sixty patents on telephones and auxiliary apparatus, all of which, in accordance with my contract, I assigned to the company. I could have taken out many more if there had not been so many other matters for me to attend to. The business was growing very fast. In April, 1877, only six telephones were in practical use with little or nothing in the way of auxiliary apparatus. On November 1, 1877, three thousand telephones were leased with the apparatus needed for their practical use. Responsible for all the technical and engineering work required by this rapid increase, I could not give my time solely to those things on which a patent could be obtained. If something was needed to remedy the defects that the public use of the telephone was constantly developing, I had to devote myself to that, whether what I did was patentable or not.

The first telephones were installed on private lines but we realized from the first that in the central office or exchange system was to be their principal use. E. T. Holmes of Boston and Thomas B. Doolittle both claimed priority. I was not interested in the controversy. It was a matter of only a few days. Mr. Holmes was our Boston agent and I was familiar with his central office for I used it as my laboratory for studying the requirements of this important part of the business. The first telephone exchange to be started on a regular commercial basis was that at New Haven, opened by George W. Coy on January 28, 1878.

CHAPTER XVI

ABOUT this time we found we were to have a competitor in the telephone business. The thousands of telephones we had put into successful operation had at last proved to the Western Union Telegraph Company that Bell's invention was a good deal more than a toy, and, as the Bell patents were no longer for sale, that Company started into the business on its own account, ignoring our patents.

In February, 1878, I made my first trip West to inspect the telephones that were in use, to induce our agents to establish Central Offices and to find out what the Western Union people were up to. My route took in Chicago, Milwaukee, Pittsburgh, Washington and all the larger cities en route. I found our telephones giving fairly good satisfaction to the users although, when I tested them, I thought they worked poorly compared with new telephones, for neither telephones nor bells had been cleaned or adjusted since they left the shop and my time on this trip was largely spent in showing our agents how to keep the instruments in order and arranging for their regular inspection.

I ran across many magneto telephones which the Western Union Company was putting out in competition with ours. They were clearly modified Bell telephones but our agents told me that, although the opposition telephones were beautifully made, they didn't work as well as ours. Certainly those I tried were inferior to those I was sending out even though ours had not been kept at their best. I was boyishly indignant at the Western Union Company's infringement of the Bell patents but I consoled myself with the thought, if they couldn't make any better telephones than those, we needn't fear their competition.

The trip gave me a new realization of the colossal nature of the telephone business and of the work still to be done to put it comfortably on its feet and enable us to hold our own against competition. I went back to Boston feeling that both the telephone and the call bell needed further improvement and that more auxiliary apparatus must be devised. For the first time I began to feel my load for the work was getting ahead of me and I had little help. In fact, I had done even the bookkeeping up to August, 1877, when to my great relief, Robert W. Devonshire, now vice president of the American Telephone and Telegraph Company, was hired to take charge of that part of our affairs. The beginning of telephone bookkeeping is in my private notebook wherein I recorded the names of the lessees of the first twenty-six telephones that were put into practical use.

My trip lasted about three weeks. The first thing I did when I got back to the shop was to remedy the defects in my bell that inspection had revealed. It was of the utmost importance to make the bells reliable for if they did not work the telephones couldn't be used. Energetic work for a few weeks put the bell, especially the ringer wherein were the most serious defects, into good shape. I junked a lot of the old bells and when I sent out the new ones our agents had no further trouble with this feature of the apparatus.

Then I turned my attention to what seemed next in importance—an individual call bell. At that time our agents were in the habit of installing many telephone stations on one line, sometimes as many as twenty, each station having a different signal on the call bell. But the constant ringing in all the stations when any one was wanted became a nuisance and some device was needed by which any one station could be called without disturbing the others. I wasted a lot of time devising an instrument for this purpose but, although I succeeded, it was too complicated for practical use. The only solution was to put fewer stations on a line, and as our agents were soon forced to do this for several reasons, an individual signal was no longer needed.

Next, I had to give serious attention to switchboards for Central Offices. On my trip I had induced several of the agents to establish such systems and they wanted me to work out the switchboard problem that immediately arose. I made a simple switch that answered the purpose, at least one feature of which is an essential part of the switchboards of the present day.

Now we began to hear rumors of a powerful battery transmitter that Edison had invented and sold to the Western Union Company, with which, its agents boasted, they were going to drive the Bell people out of business. I soon had an opportunity to try one of the Edison Carbon Button transmitters. I found it startlingly loud and clear in its articulation. Then, my other troubles became trifles under the shadow of this new cloud on our horizon. We had no transmitter equal to the Edison but that didn't worry me much for I felt sure I could devise one as good. What troubled me most was the Western Union people's claim that the Edison transmitter was not subject to Bell's patents for, if they were right, the future of our business looked dark to me. I had no means of judging how strong their claim was for the Bell patents had never been adjudicated—that was far in the future—and it was uncertain how broadly the courts would finally interpret them. Anyway, it would be years before we could get a decision from the Supreme Court and, in the meantime, what couldn't the greatest corporation in the world do to us—a struggling, poverty-stricken little company without credit, that couldn't have paid its bills if Tom Sanders, our big-hearted treasurer, hadn't advanced the money we needed out of his own resources, already strained to the limit. I wasn't in a healthy state of mind when in 1878 I tackled the problem of devising a transmitter to beat the Edison.

We had used up to this time the magneto transmitter. It was simple and reliable but it required loud talking on the part of the user. This was the time when they used to say that all the farmers waiting in a country grocery would rush out and hold their horses' heads when they saw any one preparing to use our telephones. That was somewhat exaggerated but there was truth enough in it to make the situation precarious for us. Our agents were clamoring for better transmitters than we were sending them, asserting that the Edison was beating them wherever they came into competition with it.

Fortunately, I had cleared my slate of most of the other things that had been claiming my attention and could go into the new work much less hampered than if it had been sprung on me six months before. I began my search for a transmitter in April, 1878, using carbon as the variable resistance element, but, on discussing the matter with Chauncey Smith, our counsel, he told me that, although he was certain the Edison transmitter was covered broadly by the Bell patents, yet he thought it probable Edison might have a valid claim for the use of carbon and, for that reason, said I must experiment with other materials. This advice changed a simple problem into a very difficult one, for it was easy to make an efficient transmitter with carbon electrodes, but impossible at that time to make one with any other material.

CHAPTER XVII

BUT I soon had to stop my work on the new transmitter, for the agents I did not visit on my first trip were clamoring for some one to come and bring them up to date. On May 21, 1878, I started again on a tour of inspection and instruction, a trip which was longer than my first one and covered more ground. I went West to St. Louis and South to Nashville. On this trip I first met Theodore N. Vail. Mr. Hubbard had felt for some time that there was too much of a load on me and had been looking for some one who would relieve me of all except the engineering work. He was enthusiastic over Mr. Vail but before deciding wanted me to meet him. For this reason my first stopping place on this trip was Washington, where Mr. Vail had his office as superintendent of the United States railway mail service. We had a long talk about the telephone business and I think what I told him was a factor in deciding him to come with us. I was sure he was the right man for us and, delighted with the prospect of getting rid of the part of my work I didn't like, I telegraphed Mr. Hubbard to hire Mr. Vail if he could see his way to paying him the large salary he wanted, thirty-five hundred dollars a year! Before

I returned from this trip Mr. Vail had been engaged as our general manager.

I did something else of importance in Washington at that time. A young man named Emile Berliner who lived there had written us that he had a telephone transmitter which he would like to have us try. After my talk with Vail I called on Berliner and tested his transmitter. It talked fairly well but it had the carbon electrode I had been forbidden to use. However, as he had constructed it many months before, I thought he might antedate Edison in such use of carbon and advised Mr. Hubbard to make some agreement with Mr. Berliner for the use of his invention. Soon after he came to work for us in Boston, becoming one of the most prolific of the early telephone inventors. He did important work in the development of variable contact transmitters and in other features of the new art of telephony, taking out many patents on his ideas. His original application for a patent met with such opposition in the Patent Office that his patent was not granted until 1891, ten years after I left the telephone business, and the importance of this patent in telephone work is indicated by the legal controversies over it which lasted until 1903.

The first day of my trip West from Washington was entrancing. Going through Harpers Ferry and the Alleghenies, I could forget for a while the telephone and its tribulations. These were the grandest mountains I had yet seen but neither these nor any others I have seen since made such a deep impression on me as the White Mountains did—the first I ever saw.

On this second trip among the agents, although some of the old troubles had been conquered, I found plenty of new ones to attend to. Besides trying to remedy these new difficulties I urged the agents to extend the central office part of the work. One of the statements I took West with me to convince our agents of the success of this feature in the East was as follows:

"Lowell, Massachusetts, office. One day's work, called 452 times, connected lines together 85 times; 115 office subscribers already in, 40 to be connected."

No wonder our agents rushed the central office business after I gave them these astounding figures!

I was also anxious to find out how much the enemy was getting ahead of us for Western Union competition was increasing rapidly. But I soon found I was losing my vim for the weather was hot and the drinking water deadly in some of the western cities, and I arrived at St. Louis with a bad attack of indigestion and insomnia.

Having read a good deal about the Mississippi River, which I now saw for the first time, and the lively steamboating on it, I decided I would take a vacation and get a new experience. After finishing my work in St. Louis I took passage on a small boat bound for New Orleans. There was nothing rapid about that boat; it stopped many times a day to deliver and receive freight and passengers directly from the river banks, but the trip gave me the first relaxation I had had for years. I drowsed all day on deck oblivious to telephone troubles and did not even write the Boston office where I was. After ten days of this delightful loafing I felt like a new man; then my conscience beginning to trouble me, I abandoned the boat at a small town, where I got a train for Nashville, energetically resuming my tour of inspection. Here I found telegrams from the Boston office indicating their anxiety about my silence.

On this trip I first met a demand for hotel telephones and one of the first things I did on my return to Boston, June 23, 1878, was to devise one suitable for this work. Fortunately for me, about this time the agents began to utilize their local talent to work out some of the simpler problems arising in connection with their rapidly growing business without calling on me for everything they needed. This relief was particularly welcome just then for our agents were writing us tales of woe about the Edison transmitter and I had to give my undivided attention to getting an instrument that would successfully meet that competition.

During the rest of the summer of 1878 I devoted all the time I could spare from the routine work of the telephone business to experiments on battery transmitters, using contacts of polished steel, oxidized steel, platinum, brass, zinc, antimony, bismuth and many alloys, avoiding the use of carbon under the advice of our counsel. I made transmitters in which I used all these materials, except carbon, with single contacts, with multiple contacts, with polished surfaces and with surfaces coated with various materials. Steel contacts were the best but the adjustment of them all was too delicate for practical use. I also experimented with Berliner's pivoted contact-transmitter using metal contacts in it. They all talked, some of them very well. My notebook also gives the particulars of several attempts I made that summer to improve our magneto transmitter but without success. Its limit had evidently been reached in the standard box telephone we were using.

We tried to make each other believe that a carbon transmitter wasn't essential to our welfare but we all knew it really was. This letter from General Manager Vail is interesting as showing the state of our minds at that time. It was written from our Reade Street office in New York to me in Boston, on September 8, 1878:

My Dear Mr. Watson:

They are getting up considerable excitement over the Carbon Telephone here; in fact, they say too much for their own good. People can be deceived but they will not stay in that happy condition a great period. Still we want a carbon telephone bad; it has now become a necessity. We want a good one but I don't think we will ever use many of them except it may be in the lower part of this city and perhaps in sections of other cities where there are peculiar obstacles to overcome. I wish you were here, there are several things I would like to talk over with you and get the benefit of your advice and judgment. Everything looks well; in fact, I have a growing faith in the future of the "Bell." It will take some pretty stiff pulling on the part of all of us to get the thing moving steadily—but after that its inertia will keep it going.

When do you think you will be here?

I had a talk with Applebaugh, he wants some cash for his idea. I told him you would be down the latter part of the week, when we could talk the matter over. He is also at work on some plan to destroy induction. Is that a possible thing to do, do you think?

Very truly,

Theo. N. Vail

I don't know whether I should have succeeded or not in finally getting a commercially successful non-carbon transmitter. I was still hard at work at it when, one day in October, 1878, Francis Blake came into the shop with a rough model of a transmitter he had designed. I tested it carefully. It talked fully as well as the Edison and, although the carbon electrode, tabooed for me, was its essential feature, our immediate need of a transmitter to compete with Edison's was so urgent that I told Chauncey Smith, our senior counsel, we couldn't wait any longer for the development of a non-carbon transmitter, that I doubted if I could hold out much longer under the strain, and that we should buy the Blake rights and run the risk of using carbon contacts. He finally agreed with me that it was the best thing for us to do and I recommended that our Company make a contract with Blake. This was done and I gladly dropped my experiments on non-carbon transmitters. I put all the energy I had left into getting the details of the Blake transmitter into shape for easy and rapid manufacture and had a thousand in use within two months, working even better than the Edison.

Blake's patent when it issued after a long fight in the Patent Office, was for a small detail. His transmitter was covered by Bell's fundamental patent, by Edison's on carbon electrodes and by at least one of Berliner's.

With this feverish experimenting out of the way, I could again turn my attention to our agents with whom it had now become necessary to keep in closer touch. Telephone research could no longer be exclusively carried on in any one place. The entire country had been turned by our agents into an experimental laboratory wherein the study of the telephone and its appliances, at work, must now be made.

The routine work connected with the manufacture of our apparatus had become so great I could no longer do it alone and other men had been hired to help me. The first of these was young Edward Wilson, who had been with me since 1877. In September, 1878, came Emile Berliner. He was soon followed by George L. Anders, J. B. Henck, W. W. Jacques, E. T. Gilliland, Thomas D. Lockwood, and others. Delegating to them much of my work in the shop and laboratory, left me free for more frequent trips among our agents, from each of which I brought home a fresh batch of telephone problems to be worked out.

One of the interesting things I did early in 1878 was to install telephones in a mine for the first time. Gardiner Hubbard and Thomas E. Cornish, our agent in Philadelphia, were with me on that important occasion. It was a deep and very wet coal mine on the Reading Railroad but by running covered wires down the shaft, we had no difficulty in establishing communication between the underground workings and the mine office. It worked so well the owners ordered a permanent installation. I made no change in the telephones for underground use. In wet mines the regular instruments were installed in watertight boxes.

CHAPTER XVIII

BITTER litigation now began over Bell's patents. As soon as it became evident that the telephone was likely to be a financial success, rival claimants to priority in the invention made their appearance and induced the Patent Office to put their applications for patents into interference with Bell's already issued patent. In such an interference suit the first step is filing in the Patent Office a preliminary statement by each claimant setting forth what features of the invention he claims, the date when he conceived the idea and when he first constructed a working instrument.

In the fall of 1878 all the parties to this suit except Bell had filed their statements and it was necessary for him to do the same at once. But he was still in England and letters from him indicated that he had been having a hard time there, that he was disgusted with the telephone business and determined to have nothing more to do with it. In October he wrote that he was leaving England, was going directly to his father's house in Ontario and wasn't coming to Boston at all. Our lawyers warned us that Bell must come to Boston immediately to preserve his rights. We knew from his letters that he was utterly indifferent to the whole matter, and we realized that unless we acted quickly he would be too late to save the situation. Mr. Hubbard, Mr. Sanders and I conferred with our lawyers to determine what was best to do. Some one, I think it was Mr. Hubbard, suggested that the only sure way to get Bell to come to Boston at once was to have me meet him at Quebec when his steamer arrived. This seemed advisable and on November 8, 1878, I went to Quebec and waited until the 10th, when the Allan Line steamer arrived with Professor and Mrs. Bell, his baby girl and nursemaid. I found Bell even more dissatisfied with the telephone business than his letters had indicated. He told me he wasn't going to have anything more to do with it, but was going to take up teaching again as soon as he could get a position. I gave him as clear a picture as I could of what we had accomplished in the United States, painting the future of the telephone business there in bright colors. I made some impression on him for he finally said he would go to Boston with me after he had taken his wife and child to his father's house in Ontario. I went with him for I didn't want to run the risk of losing him, and stayed there several days before I succeeded in getting him started for Boston. He would not go until he had received an affirmative answer to a telegram he dictated and had me send to Boston, of which I find a copy in my notebook. It reads: "Will Company pay Bell's expenses incurred in its service to Boston and back?" Of course, the answer was "Yes."

Bell was sick and had to go to bed as soon as he got on the sleeper. On arrival in Boston he went to the Massachusetts General Hospital for an operation. His preliminary statement, dated November 20, 1878, was made while he was there but it was filed in time and, perhaps, saved his patent.

Bell hadn't been with us many days before he realized that the telephone business in the United States was vastly more promising than it was in England and likely to be such a financial success that it would not be necessary for him to teach for a living. He recovered from his sickness in a few weeks, but aside from his testimony in this suit and others that followed, he never took any active part in the telephone business for its details did not interest him. He had other inventions in mind to which he preferred to devote his time.

From my earliest association with Bell he discussed with me the possibility of making a machine that would fly like a bird. He took every opportunity that presented itself to study birds, living or dead. On one occasion I witnessed his enthusiasm and interest when doing this. He lived in Salem, Massachusetts, when I first knew him, and sometimes went with me on my walks. One Sunday we found a dead gull on the beach at Swampscott. Bell spread it out on the sand, measured its wings, estimated its weight, admired its lines and muscle mechanism, and became so absorbed in his examination that, fastidious as he always was, he did not seem to notice that the specimen had been dead some time. As I was less enthusiastic I was obliged to keep well to windward of the bird during the discussion. He was also interested in a very light steam engine and boiler I had built which he thought might, if made larger, furnish power for a flying machine. I fancy if Bell had been in easy financial circumstances he might have dropped his telegraph experiments and gone into flying machines at that time.

Bell was so certain that flying was practicable, just before he went to England in 1877 he made me promise that, as soon as the telephone business became established, if it ever did, I would leave it and start experiments with him on flying machines. But when he got back to this country in November, 1878, I was too much tied down to telephone affairs to drop them and carry out our agreement. He did not, however, begin at once experiments on the flyer for he was then boiling over with other ideas. One of the first things he worked on after he came out of the hospital was a wireless telephone that would talk over a beam of light, utilizing the varying electrical resistance of selenium when light of different intensities strikes it. Bell had this beautiful idea well worked out in the winter of 1878-79, when he talked to me over a beam of light reflected by a parabolic mirror from one of the Technology buildings in Boston to another two hundred feet away. This invention of his was of no immediate practical value but, if we are ever able to see by telegraph, the apparatus that does it will undoubtedly be based on Bell's Selenium, Beam-of-light telephone transmitter.

Soon after, Bell engaged one of my early shopmates, Sumner Tainter, a fine mechanic, to work with him, on phonographs, I think. Thereafter Bell's experimenting was done in Washington and I saw little of it. Much of this work has been of scientific value and some of it successful financially but none of it has brought him the fame and money reward that the telephone did.

CHAPTER XIX

IN the fall of 1878 our offices were for a few months in a loft on Reade Street, New York. I spent some of my time there but most of my activities, besides my tours of inspection, required my presence in the shops in Boston. In February, 1879, we moved our headquarters back to Boston and were prosperous enough then to occupy a handsome suite in the Mutual Life Building on Milk Street. I now had an office to myself and a clerk to do my writing but, being obliged to spend my time supervising the work of others, I was not so happy as I had been, for only when I worked with my own hands did I have the delightful feeling of creation.

I had enough to fully occupy my time, for every lot of telephones, transmitters, call bells, switchboards, etc., contained some improvement over the last lot. All was a state of flux, not a piece of apparatus nor a method of using it was entirely satisfactory, and new and puzzling problems were arising. One of the things that had become very serious in 1879 was induction or cross talk between our wires on the same poles and between our wires and nearby telegraph lines. My notebook records several devices with which I tried to overcome this, but I had little success, for we were beginning to find difficulties that were at that time insuperable, as they required more experience and more mathematics than any one on earth possessed at that period.

I was trying out one of these devices on the new central office switchboard at 40 Pearl Street, Boston, to which the Holmes Exchange at 342 Washington Street had just been transferred—probably the first exchange cut-over that was ever made—when I met for the first time a young man employed there who has since reached a position at the very top of telephone affairs. He rose from the ranks until he is now the most famous telephone engineer in the world—General John J. Carty, vice president of the American Telephone and Telegraph Company, in charge of the company's technical affairs.

A much greater and more insuperable trouble than cross talk was looming on our horizon at this time. Electric light and power systems were being installed in some cities and trolley cars were starting to run. This powerful electric apparatus was connected to wires that used the earth to complete the circuit just as we did with our telephone wires. Consequently their heavy currents entered our wires and shattered the telephone's delicate electric waves, rendering communication difficult and often impossible. There was but one remedy possible—the substitution, at great expense, of metallic circuits for our grounded wires. I began this on a small scale but it was several years before our wires were all changed to double circuits.

In the winter of 1878 we had our first experience with sleet storms. All telephone wires at this time were above ground, the only cables being those running under drawbridges. The wires were carried on great wooden frames on the housetops or on poles planted on the edge of the sidewalks. There were so many of them that a view of the sky from the streets of almost any large city at that time was like looking through a gigantic sieve. The conditions for a catastrophe were perfect and the first wet snowstorm plunged us into one. It was a disheartening sight when, after a night of wind and sleet, I saw in every direction the wreck of our structures and poles. Such expensive calamities happened every winter, until the fact that there was no more room for our wires in the streets and on the housetops forced us to study the problem of underground cables, but the cost was so enormous and the technical difficulties were so great that it was many years before underground cables were made practicable.

Speaking of the cost of these things reminds me how thankful I was that I was not treasurer of our company during these years of struggle and poverty. Thomas Sanders of Haverhill, Massachusetts, was our treasurer, and we could not have had a better one. Had it not been for his never-failing pluck and optimism, Bell and the rest of us might have missed the prosperity that came later. Everybody loved jovial Tom Sanders! No matter how gloomy our skies were, they always cleared when he came around. I think he would hardly have been rated as a conservative business man, and it was lucky for us that he was not that kind of person, for, had he been, he would never have risked his fortune as he did to supply us with funds in those uncertain years when the telephone was a toddling infant.

Some one has said that the men who controlled telephone affairs in their babyhood—Bell, Hubbard, Sanders and Watson—were just the men for the job, each doing his part of the work without interfering with the others, making a smooth-running machine. It would not be modest in me to fully endorse this judgment but, as far as three of them are concerned I can do so heartily. Gardiner Greene Hubbard's function in this machine was of the highest importance. His keen, far-sighted mind, conceived some of the fundamental policies which are to-day an essential part of the stupendous telephone business. My work brought me into close contact with him for several years. When I first knew him and found that he was not up in electrical or mechanical things, I felt superior; but I soon lost my small self-conceit. I had not known him long before I was greatly impressed with his power to grasp every aspect of a difficult situation and deal with it serenely. I never knew him to get excited or lose his head over any emergency that arose. If, when I returned from an inspection trip, I brought him tales of woe, for instance, an account of the way the opposition telephone company was cutting into the business of some of our less efficient agents, I was always reassured by his calm reception of my bad news, and went away feeling that he was capable of taking care of that part of our business. He always appreciated the work of others. One day, when our financial affairs were beginning to look brighter, he said to me, "Well, Mr. Watson, that contract you made with us was a good thing for you"; then, after a pause, with a twinkle in his eye, he added, "and a good thing for us, too." One could not help liking a man who said such nice things.

Nor must I forget Charles Williams' part in the drama of those early days. To him also the first telephone men have every reason to be thankful. In his shop, where I was first initiated into electrical work, was manufactured during the years of our struggle for life practically all of our telephones and auxiliary apparatus. Mr. Williams' faith in us and in the future of the telephone was so great that he strained his resources and credit to the limit not only by enlarging his shop to meet the demands of our growing business but, also, when our treasurer was hard up, by giving us plenty of time to pay our big bills. I ran up the bills; Williams and Tom Sanders had to arrange for their payment. And

I noticed that Williams was often very sober when pay days were approaching. I fancy he found himself many times in critical financial situations during those early years. But his faith in us had its reward, for when the telephone business began to pay he benefited handsomely by our prosperity.

I suppose I did have some fun during this busy, anxious period of my life but, aside from my walks in the woods and an occasional evening at the theater, the only diversion that lingers in my mind is the experience I had when I fitted telephones for the first time in a diver's suit. Contractors for the State of Massachusetts had just finished a great sea wall at South Boston. There was a dispute over the quality of their work under water and it became necessary to send a diver down to measure hundreds of joints in the stone work. It was a tedious job, for, after making a measurement, the diver wrote it in pencil on a bit of wood and let it float to the surface for the clerk in the boat to grab, or he would keep in mind a few measurements, be pulled up, have his helmet removed, and repeat the measurements to the clerk. This was tedious and one day the diver who was doing the work came to me to see if I could arrange a telephone in his helmet so he could transmit his measurements through it. Seeing no reason why it could not be done, I had two flat telephones made, one of which I fastened inside the helmet near the diver's mouth and the other close to his ear, running the connecting wires outside the air pipe to a telephone in the boat. It worked nicely out of the water and I was surprised when the diver reported that he could not hear a sound when he was under water. From his account I could not determine what the cause of the trouble might be, so I decided to put on his suit and go down myself, which I did to the intense alarm of my young assistant, who was helping me that afternoon. I still feel the pathos of the moment as well as the scare of the new experience when, arrayed for the descent in the diver's suit, with lead-soled shoes on my feet, just before I disappeared, perhaps forever, beneath the limpid waters of Boston Harbor my young friend put his arm around my armored neck and kissed me on the thick glass plate, behind which he could see my anxious face. I soon found the reason why the diver could not hear was the noise the air made escaping through the valve. I did not see how it could be remedied and so I began to walk about and enjoy my submarine trip. Suddenly I stumbled over something in the mud and fell on my hands and knees. Then the bubbling stopped and I could hear them talking to the telephone in the boat. When I stood up the bubbling began again but stopped whenever I bent my head low down, for then, instead of going out through the valve, the air accumulated for a few moments in the loose rubber suit. I signaled to be pulled up and told the diver what I had discovered.

After that he had no further trouble in communicating with the surface during his work and could remain under water a long time. When he wanted to hear what was said through the telephone he merely had to make a profound obeisance to stop the noisy bubbling. The work on the sea wall was very much facilitated by the telephone, which is now a regular part of a diver's outfit.

CHAPTER XX

THE interference suit in the Patent Office over Bell's patents was only the beginning of our legal troubles. Early in 1879 our weak little company sued the Western Union Telegraph Company, the largest corporation in the world at that time (or, more accurately, sued an agent of the American Speaking Telephone Company, an organization formed by the Western Union Company) for infringing the Bell patents. As I was, of course, an important witness in that suit, it became necessary for me to give a good deal of my time to testifying and preparing models of the original telephones. In this suit and in the others that followed it, I was often in the witness box for days at a time telling all I knew about Bell's invention. This litigation could not have started at a worse time for me as the experimenting I was doing, the new troubles that were cropping up, and the routine work of the business were quite enough to fill my time all day and much of the night. But this legal work was of the utmost importance and could not of course be slighted as our business lives depended on a favorable outcome.

These law suits were a source of anxiety to all of us. Our opponents had plenty of money to spend in their efforts to break our patents. Their experts searched the literature and archives of every civilized country trying to find evidence to prove that some one else invented an electric speaking telephone before Bell did. And they also hired every one they could find who thought he had a claim to some feature of the telephone, to help them in the fight.

The printed record of these legal battles over the speaking telephone is voluminous. The library of the American Telephone and Telegraph Company contains three hundred large volumes of testimony, pleadings, briefs, arguments and court decisions in the various telephone cases, recording in detail the proceedings in the six hundred suits brought for and against the Bell patents between 1878 and 1895, in the Patent Office, in the various United States Circuit Courts, and in the Supreme Court at Washington. This library is the record of what Judge Brower referred to when, in reading a decision in our favor in 1892, he said: "Out of the dispute over Bell's claims has come the most important, the most protracted litigation that has arisen under the patent system in this country."

The public of to-day knows little or nothing about this exhaustive litigation over Bell's patents, which is undoubtedly the reason why I still meet persons who believe that Bell is only one of many inventors of the speaking telephone. In their minds still lingers the newspaper propaganda made by the various claimants against Bell so many years ago. The error persists but the truth is hidden in these volumes in the Telephone Company's library, which few, outside of legal circles, have either the time or the inclination to study.

It would be tiresome to any one but a patent lawyer to go into the details of these suits, in which the opposing lawyers presented with the utmost ingenuity the evidence in favor of each and every one in the long list of unsuccessful claimants against Bell—Gray, Dolbear, Spenser, Irwin, Voelker, Meucci, Drawbaugh, Baxter, Cushman, Holcombe, House, and many others. Finally the opposing claimants persuaded the United States Government itself to bring suit against Bell for the cancellation of the patent. But all suits, going up on appeal to the United States Supreme Court, were decided in favor of Bell.

Many of my friends have asked me in recent years if Reiss did not invent the telephone before Bell did. I am sure they would not ask this if they knew how thoroughly that question has been thrashed out in the courts. Phillip Reiss of Germany, who died in 1873, made in 1861 an instrument he called a telephone. This was used by some of our opponents in the law suits as one of their strongest points in their attempts to break the Bell patents. Like Bell's Harmonic Telegraph, Reiss' apparatus worked by making and breaking an electric circuit and for that reason could transmit only a series of taps which merge into a buzz of various pitches if one sings to his instrument, or, into an utterly unintelligible rattle if one speaks to it. Reiss' instrument was well known for fourteen years before Bell made the speaking telephone. Probably the physical laboratory of every well-equipped college in the world had one in 1870. But, although it had been studied and used in the teaching of physics by keen scientists and ambitious students for years before Bell began his experiments, no one had ever made it talk. It could not, because a make-and-break current can carry only the pitch of a sound and none of its delicate overtones. Then Bell made his revolutionary discovery of a sound-shaped electric flow which, undulating without interrupting the current, could carry all the vibrations of any sound, even those of human speech, with such fidelity that the listener knows who is speaking. When Bell published this to the world in 1875 it was an easy matter for any one to modify the Reiss apparatus to accord with Bell's discovery. Then it would talk, but it was then a Bell telephone. In fact, the ordinary telegraph keys and sounders could be used as telephones after Bell showed how.

The lawyers opposed to us offered the courts a great quantity of documentary and expert testimony to support their contention that Reiss antedated Bell in the invention of the speaking telephone, but they could not prove that any one had transmitted through it a single intelligible word before the date of Bell's patent. Our opponents further contended that if Reiss did not actually make his telephone talk, yet he went so far with it that Bell's invention was merely an improvement on his. They of course exhibited a Reiss instrument that talked but, unfortunately for their clients, it would talk only when they had modified it in accordance with Bell's patent of March 7, 1876, and used one of Bell's receivers. Their labor was entirely in vain, for no court ever found that Reiss in any way anticipated Bell. The contention was well summed up by Judge Lowell of the United States Circuit Court, who, in rendering in 1881 his decision in Bell's favor in the Spenser suit, said: "A century of Reiss would never have produced a speaking telephone by mere improvement in construction." In another suit, after the United States Supreme Court had reviewed the Reiss evidence, Chief Justice Waite declared the decision in Bell's favor, saying: "It was left for Bell to discover that the failure of Reiss was due not to workmanship but to the principle. . . . To follow Reiss is to fail, but to follow Bell is to succeed."

For nearly twenty years the Bell Company was obliged to defend itself, at immense expense, in these suits. In most of them our opponents gave up the fight before they got to the higher courts. Twelve of the suits, however, reached decisions in the circuit courts and five finally got before the Supreme Court at Washington. Every case was decided in favor of Bell.

No one can to-day doubt the validity of Bell's claims who knows how they have been fought over time and time again by the most capable lawyers of this country with ample funds at their disposal and stimulated by the great financial reward and professional fame that success in breaking Bell's patents would have brought them and their clients. No patents were ever submitted to a more intense legal and judicial scrutiny than Bell's have been. If any human question can be considered as settled, this matter of Bell's claim to the invention of the electric speaking telephone is certainly one.

The suit we brought against the agent of the Western Union Company in 1878 was of great importance to us, for, being the first time the Bell patents had been brought to judgment, we did not know what unexpected things our opulent enemy might spring on us, nor what the attitude of the courts would be towards Bell's discovery of a new scientific principle. But we knew that a decision against us at that critical time in our finances would have ruined us and, probably, have put the telephone business into the hands of our adversary. We needed money badly, but could not get as much as we needed because a fight between such a weakling as our organization was, even though it was spunky, and such a giant as the Telegraph Company, looked so hopeless to the average man that few had the courage to buy our stock.

But the skies cleared sooner than we expected. The trial of this first suit was never completed, for, when our testimony was all in, our opponents' senior counsel, George Gifford, made up his mind that they had no chance of winning and advised his clients to settle with us. The Telegraph people took his advice. By a settlement signed on November 10, 1879, they abandoned the suit, acknowledged the validity and scope of Bell's patents, and went out of the telephone business, turning over to us all the telephones they had in use.

Of course, we were all mightily pleased at this ending of a serious affair and I felt as if a crushing weight had rolled off of me. If Bell had been in Boston I should have invited him to join in one of our old war dances but, as he was not available, I had to have my dance all to myself, celebrating this great event in my life with a whole day alone in my old haunts—the woods and shores of Swampscott and Marblehead, declaiming to the skies all the poetry I remembered. It was an undignified thing for the Chief Engineer of the Telephone Company to do and also a waste of his time for there were a lot of things waiting for him to attend to in the shop. But I certainly felt better for it next day.

CHAPTER XXI

OUR company then bore the title of The National Bell Telephone Company, capital $850,000. A few shares of its stock had been sold in the stock market during the summer of 1879 to some one who evidently had followed the evidence in our suit and believed that we had a good chance of winning. He made a shrewd gamble. The first sale was on June 11, 1879, for 110¼ a share. On August 30 another sale was made at 227½. On September 10 an impulse of confidence carried it up to 370, but it settled back on September 13 to 305. Then on November 15, after the news of our victory had become known, it jumped to 977½. And on December 10, 1879, even though we had never paid a dividend, it sold at $995 a share, the highest figure it reached at this time, and a fine expression of the public confidence in the future of the telephone. This was surely a boom, but all the transactions were small and very little stock was for sale. Great as this increase in the value of Bell stock was in 1879-80, it is interesting to note that no one ever made a fortune from the telephone business in any way comparable to those built up by railroad, oil, steel or many other interests.

It is safe to say that at least a hundred persons have told me during the last forty years that Professor Bell tried to sell to them, or to their fathers or uncles, or intimate friends, his telephone stock at a very low figure—$10 a share is the price usually mentioned—and that, to their everlasting regret, they missed this opportunity to become rich by refusing Bell's offer with some such cynical remark as, "I have no money to throw away on such foolishness as a telephone." It is a pathetic picture that this conjures up, but all these stories are untrue, for neither the great inventor nor any of his associates ever peddled a share of Bell stock. If either of us sold any it was through a broker on the stock exchange after it had a market value above par.

A popular variation of this story is that some one owned a big block of telephone stock, and being in financial trouble gave it to a creditor, who took it unwillingly as a thing of no value, but who afterwards became wealthy from it, while the hard-up man who brought him his fortune struggled on in dire poverty. This is also fiction.

This rapid increase in the value of telephone stock interested me very much. It was thrilling to reckon up each evening from the stock market reports how much my stock had increased in value during that day and what its total value then was. I enjoyed this pleasant pastime hugely for a few weeks; it was quite like the storybook miser gloating over his bags of gold. But, to my surprise, for I had never read that this avaricious person ever became tired of counting his money, I soon lost interest in gloating over my gains. After a delightful month or so they ceased to give me anything more than a comfortable feeling that I had now nothing more to worry about as far as money was concerned.

This was a delightful but somewhat dangerous situation. And I am not sure that it conduces to the development of the best in a young man to be released from the necessity of earning his bread and butter. One who lives too early in life on an income not earned by daily labor misses many experiences good for his soul. He can shirk things he ought to do and can easily do other things he would better avoid. All of which is quite true, but I have not known any one who was not willing to risk the moral dangers of living on the sweat of his safe deposit box if it had enough in it to enable him to do so.

Now I could realize some of my dreams! As soon as my stock became saleable, I sold enough of it to carry out the desire that had been in my mind ever since I was a schoolboy—to buy my mother a house. It would have been better for me financially if I had postponed this for a few weeks, for then I should have got much more money for the stock I sold, but I could not wait any longer. As my father was not well enough to continue his work in Salem, I decided to get a house near Boston. I found one in Everett with a barn and a large garden. I bought it completely furnished in order to save delay in settling my parents in Everett and, as I was tired of boarding, I moved there, too.

I had other dreams of long standing which, I am glad to say, were all quite commendable though not at all exciting. I bought a piano and began to take lessons on it but, although I had reconciled myself to the fact that accuracy in striking the keys was desirable, even necessary, I was too old to learn anything more than the rudiments of the art. However, I got a good deal of pleasure from my music, simple as it was. I also bought a horse but I did not like the thing and he knew it, for he took every opportunity to show his contempt for me. It was especially apparent in his refusal to acquiesce whenever I tried to accelerate his subnormal speed. One day he resented my urging by kicking the front of my buggy to pieces. Such violence on his part seemed to me excessive, so I sent him to auction and bought another that had a better disposition. But he was hardly my ideal of what a horse should be, either, and I never found one that was. I learned afterwards that my first purchase was not a fair specimen, and I am afraid the man I bought him from forgot to tell me some of his characteristics, although I am sure he was well acquainted with them. I bought some tools and did something else I had always hankered for: digging, planting, trimming trees, mowing the lawn, etc. I took French and singing lessons and started to carry my mathematics beyond the point where I had dropped it when I left high school twelve years before.

As I still had to keep up my telephone work, these delightful side occupations had to be carried on early in the morning or at night and they were often interrupted by trips among the agents. After six months filled with such varied and absorbing interests followed energetically, it is hardly to be wondered at that I found myself used up with indigestion and insomnia. In 1878-79 Mr. Hubbard had taken me several times, when he thought I needed bracing up, to Kimball's famous hotel on the Cohasset shore, and so in the summer of 1880, when I did not feel well, Kimball's was the first place I thought of.

My favorite loafing place during the delightful month I spent there was a shelf in the seaward face of a ledge near the old hotel. There I would lie for hours contented to do nothing but sleep and look at the wonderful sea pictures stretched out before me. My brief vacation banished indigestion and sleeplessness but, for some reason, perhaps the prospect of dividends soon to come, my studies, books, music, garden, the rocks and the sea, and all the outdoor world became more attractive to me than the telephone business and I began to look forward to a blessed time when I should be free from the load I had carried for six intense years. And I am certainly grateful to the Cohasset shores not only for the renewed health it gave me in 1880 but also because I found there the girl I afterwards married.

My telephone work in 1880 was much the same as that of the previous year. Induction or cross talk between our wires on the same poles gave us more concern than ever. My notebook tells of my attempts to make our longer lines work better by using higher resistance grounds, larger induction coils, condensers, etc., but with little success.

There was a remedy, but the time had not come when we could use it. Michael Faraday had, many years before, stopped electrical interference between adjoining metallic circuits by twisting the two wires of each circuit about each other. But our circuits were single wires, grounded at each end, and Faraday's idea was not applicable to grounded circuits. A few years later when all telephone circuits had been made metallic, this twisted wire idea became of great importance and is to-day essential to the operation of all cables and long distance pole lines. Bell himself was partly instrumental in adapting it to telephone use.

I also found time to get my foreign patents into shape and to negotiate the sale of some of them. In 1880 I went to the first convention of telephone agents. It was held September 6 at Niagara Falls, under the name of the National Telephone Exchange Association. I wrote out in my notebook the speech

I expected to make on this occasion, but I was too bashful to deliver it when the time came. It reflected my early attitude of hero worship toward Professor Bell and my pride at being associated with him:

> As the associate of Professor Bell in the early experiments by which the telephone was perfected and made a commercial success, and appreciating as I do his many noble qualities, I feel my inability to sufficiently honor his name. I will only say, gentlemen, that I know Professor Bell will be deeply grateful for the expressions of regard that have been tendered him by the convention.

I resigned my position with the Telephone Company in the spring of 1881. The same desire for a larger life and new experiences that had improved my fortunes by sending me from the crockery store into the machine shop, was stronger than ever, and my interest in the telephone had diminished rapidly as the lonely, fascinating, pioneer work I had been doing, covering the entire field of telephony, had necessarily been more and more divided among many workers. The prospect of spending the rest of my life in office work, in supervising and inspecting, was not attractive, nor was I fitted for it, and the future, if I stayed in the business, promised nothing else.

I fancy if I had had in my youth what was then considered to be the higher education, which would have lasted until I was over twenty years old, my appetite for study would have been satisfied and I should have been contented to stick to one job all my life, but my early schooling, limited as it was in amount and poor in quality, had done for me the best thing any school can possibly do for a boy. It turned me out with an insatiable desire to know more, and at the end of 1880, when the income question was settled for me, nothing seemed worth while except my desire to attain an elementary knowledge at least of many enticing subjects about which I had speculated but knew little.

The list of things I wanted to study—rocks, animals, plants, poetry, drama, philosophy, music, painting, languages, foreign travel—did not seem formidable to me then and such a prospective feast made the telephone business seem like the rind of yesterday's fruit. I could have taken a long vacation and returned to the work but a new path in life was more attractive, so my resignation from the business was permanent.

I have never regretted leaving the business at this early stage of its development. If I had stayed in it my life would have been easier and my present income larger, but I should have missed many experiences which, although some of them were hard to bear, have, I am sure, each and all built into me something of everlasting value.

This narrative of my telephone days is not by any means a complete history of Bell's invention, not even of those early years. It is a record of only that part of the story in which I was closely involved. A complete history of the telephone from its birth to the present day—its technical methods, business system, financial problems, legal complications, and the vast and prolific research that has been done on it—would fill many volumes.

After 1881 neither Bell nor I played a noteworthy part in the great development of the telephone into the instrument of universal service it now is. This has been done by those who followed us—by the work of thousands of trained men and women coördinated with consummate skill into an organization almost incomprehensible both in its complexity and in its size and scope, with its thousands of central offices, its tens of millions of miles of wire which, connecting millions of telephones in every nook and corner of our country, pulsate day and night with speech carried by those sound-shaped electric waves conceived by Alexander Graham Bell.

CHAPTER XXII

EARLY in June, 1881, I sailed from East Boston on the Cunarder, *Batavia,* for Liverpool. It was an old boat pervaded through every gangway and cabin by an awful smell of bilge water. We sailed in an easterly gale which stayed with us nearly all the voyage of more than two wretched weeks. I was seasick most of the time and lived almost entirely on russet apples. Before I reached England I wished many times that I were back in Boston. Telephone troubles seemed light compared with this.

In spite of my wretchedness, or, perhaps because of it, my energies, suddenly released from telephone strivings, took a philosophic turn quite like my meditations in the woods when I was much younger, but in which I had seldom indulged during my busy telephone years. In the dogmas of the various creeds I had never found satisfactory answers to the old questions, What am I and where did I come from? Is death the end of me; or do I still go on; and, if I do, where?

I had got more satisfaction from a little book my sailor half brother had brought home from Calcutta years before, from which I had learned of the doctrine of reincarnation of the human soul in successive earth lives, with resting spells between. I liked the idea even as a child and as I grew older it appealed to me more and more, for it was the most reasonable answer to my questions I had found. I lived now; what was more likely than that I should live again and again? I had had many experiences in this life and had benefited immensely by them. I could see that there were enough more experiences, which I had not had, to fill a dozen lives and I liked to think I was coming back to get some of them. I was well satisfied with my present life and could not imagine a future more attractive than to return to this wonderful earth that has such an abundance of material for studying, experimenting, discovering, constructing, wondering, thrilling.

Then, too, it seemed as if in my present life I had been reincarnated several times. School life, clerk life, machine-shop life, telephone life—each was like a separate existence as I looked back on it. I had just died out of my last—my telephone—life and these days on the sea were like a resting spell before entering another existence.

Such were my ponderings, lying on deck as the old boat rolled and pitched and the wind whistled through the rigging, and they fixed the notion of reincarnation in my philosophy more firmly than ever.

The rough voyage on that wretched boat certainly suggested passing through the shadow, but I hope real death is more agreeable. I passed through it unharmed, as I hope to pass through death unharmed, and when I was reborn at Liverpool into a new incarnation I certainly had an appetite like a voracious infant, for I had not eaten anything to speak of for two weeks.

Fortunately, the hotel I went to had the good old English plan of placing the food on a sideboard from which the guests helped themselves. A better plan for a half-starved young man could hardly be devised. Between meals, I did the usual sightseeing. The things that first caught my attention on landing were the big cart horses and the way the tooth of time had gnawed the stone work in many of the buildings. I did not know, then, what poor building material the soft English limestone is, compared with the granite which I was used to. The brownstone in some of our Boston houses wears poorly, but it merely grows ragged and does not dissolve into such picturesque shapes as the English stone.

I was met at Liverpool by a telephone man who had left me a few months before to work for a telephone company in England, where the development of Bell's invention was far behind what it was in the United States. He was a young Englishman and quite qualified to show me all the sights, legitimate and otherwise. I spent a few days with him in London but, when I acquired a taste for churches, palaces, museums, historical buildings, Dickens' localities, and picture galleries, which he did not care for, he dropped me and I went about alone.

It was rather a dangerous situation for a healthy young man, just released from absorbing work, with plenty of money, with abounding vitality and an insatiable desire for new experiences. I tried everything that offered and liked it all. But I soon became lonesome and restless, for I quickly found sightseeing was a poor substitute for real work. After a fortnight in London and vicinity I went to Norway, where my young assistant, Edward Wilson, was now living. He had been engaged in Vienna starting a telephone exchange and was now doing the same work in Christiania. I helped him a little, saw something of Norwegian family life, made a few trips through the mountains and fiords and then went to Copenhagen, where, for a few days, I was enthusiastic over Thorwaldsen's work.

My next stop was at Hanover, Germany, where another of my Boston telephone men was installing telephones. Men from the Boston group of telephone workers were the pioneers in the business all over Europe. By the time I got to Hanover I was heartily tired of sightseeing, so, after getting settled in a pleasant family I began to take lessons in the German language and literature, getting introduced for the first time to those great Germans, Goethe, Schiller, Heine. In the two months I spent at Hanover my acquaintance with their works could only be slight, but I got much out of it that has been of value all my life.

This way of passing the time was much more to my liking than what I had been doing. And I was not lonesome now, for the family I was living with treated me as one of their own and did their best to fill my leisure hours agreeably. Almost every day had its tramp in the country, a picnic, a concert or an opera. I have never enjoyed music so intensely as I did in Germany, especially in Hanover. Among other interesting things here I saw the German military machine in operation, for the army maneuvers that autumn were in Hanover.

My stay here was one of the pleasantest parts of my trip, but two months of it were enough. In October I bade good-by to my friends, who seemed sorry to have me go, took a round trip through other parts of Germany, then went up the Rhine to Switzerland. But it was then so late in the season that I could not see much of the mountains except those about Lake Lucerne. I appreciated and enjoyed their superb beauty but did not get the thrill from them I had anticipated for so many years. I had already found that beauty and pleasure vanish when they are hunted too constantly and that a glimpse of a lovely thing may be more satisfying than staring at it all day long. Novel and interesting as Europe was to me, I do not remember that it had anything more enchanting than the Boston

Public Garden was on those summer days when I played truant from the workshop, or the view of the shabby buildings from my workbench when a misty day transformed them into a soft loveliness, or my first sight of the White Mountains on that memorable Sunday when Bell and I talked for the first time over a wire more than a hundred miles long.

From Switzerland I went to Paris, where for two months I thoroughly explored the city and its environs, studying the street life, the pictures, sculptures and antiques in the galleries, visiting palaces, churches and museums. It was all interesting and enjoyable but it was not quite satisfactory. I liked Paris better after I arranged to spend half of each day in studying the French language, history, and literature. I also took fencing lessons, which absorbed some of my superabundant energy.

I found the language easy after my struggles with German. After two or three weeks I could read it quite readily and speak it well enough to make my wants known as I went about. Not finding a French family that would take me in, I hired a small suite on the top floor of a house on the Rue de Rivoli, overlooking the ruins and garden of the Tuileries, and lived there alone during my entire stay in Paris. Neither the opera nor the concerts in Paris attracted me, even when the music was German. Music did not seem to be a necessary part of life here as it was in Germany, but the French theaters were entrancing after I had made a little progress in the language. I was as keenly sensitive to good speech as ever and the diction of the players in the French theaters delighted me. I used the published plays as textbooks for my reading lessons and had little difficulty in understanding what the actors said.

I was still a poor "mixer" in spite of much mixing with people during my telephone years. I made few acquaintances and most of the time, outside of my lessons and reading, went about by myself, which was satisfactory, although I was often lonely. When I first arrived in Paris, there was an electrical exposition going on and, as Professor Bell had an exhibit there—his beam-of-light telephone, I think—he spent a few days in Paris, during which I saw a good deal of him. I was with him when he showed his invention to the Prince of Wales, to whom Bell presented me as his associate in his work on the telephone. The Prince was courteous, but I think he was bored with the many things the exhibitors tried to impress him with. I did not blame him, for the electrical show bored me and confirmed me in my realization that my appetite for things electrical had been satisfied.

I had seen other royalties on my trip—Queen Victoria at Windsor Castle, the old Kaiser William at the Opera House in Hanover during the German army maneuvers, and now, the heir to the English throne. The Kaiser impressed me most, probably because he and his staff wore beautiful uniforms, but I was somewhat disappointed to find that kings, queens, and princes were merely human beings and not at all like the resplendent deities my boyhood fancies had pictured them.

During my stay in Paris I did some telephone investigation for the home company, chiefly of telephone cables, which the French had to use from the start as they were not allowed to plant poles in the streets of Paris, as we did in our home cities. I also corresponded with our lawyers at home regarding our patent suits. My time was well filled but my occupations, pleasant and varied as they were, did not satisfy me and I did not realize why until one day I went through a French machine shop and then I saw that what I needed was to do some work with my hands, to get to work on a lathe and make the chips fly, or stand at a bench and file something into shape. I was missing badly the stimulating contact with tools and machinery that had filled the previous ten years of my life.

In December the weather turned bad and after Christmas I fled to the sunshine of Nice and Monte Carlo, stopping at Lyons, Arles, Avignon, and Marseilles on my way through France. The Riviera was delightful after the fog, rain, sleet and clouds of Paris. Allurements abounded in this charming region, especially at Monte Carlo, but the gambling in the Casino did not tempt me, although I spent a good deal of time watching the crowds about the gaming tables, a new and astonishing phase of life to me. I enjoyed the fine concerts given every day, gratis, in the lovely theater connected with the gaming establishment; but, after I had attended them a few times, my conscience began to trouble me, because, not doing any gambling, I was not paying for them. I tried to soothe that troublesome thing by putting a five-franc piece each day on a roulette table, never winning nor expecting to win. This seemed a satisfactory way of paying for my concerts but, on the last day of my stay in Monte Carlo, my luck changed, for, when the wheel stopped after I had put my silver piece on the table as usual, the croupier shoved a pile of silver over to me. I pocketed it and went away rather dazed at the unexpected turn of fortune. What I had won returned me all I had been trying to pay for the concerts and fifty francs more! What is the use of trying to satisfy your conscience when you have luck like that?

Leaving Monte Carlo the next day, I spent a few days in Genoa, Pisa, and Florence, and then went to Rome, where I settled down in a comfortable hotel and spent the rest of the winter in the picture galleries and museums, prowling about the ruins, taking long tramps in and about the city, reading Roman history and taking Italian lessons. Rome fascinated me. I soon became so well acquainted with its sights and history that my services as a gratuitous guide were utilized by other tourists who came to my hotel. I was glad to do this sort of work and time passed pleasantly and quickly. In the spring I went to Naples, which I explored as thoroughly as I had Rome. Then I started north, stopping at some of the hill towns, Venice, the Italian lakes, Milan, over the Simplon Pass to Geneva, Paris, London.

I have not gone into details of my tour, for every feature of such a trip has been written up time and time again by better writers than I can ever hope to be. Every one who goes to Europe does quite the same things and has much the same mishaps and adventures. I was inclined to rhapsodize over my grand tour when I first returned, but stopped when I observed how bored most persons were, who had not been in Europe, when some one who had just returned was telling about his travels. But my first trip abroad was an important part of my education. I met no tourist there who seemed to get more out of it than I did, and I ran across some Americans who, although they had been there only a few weeks, were mightily tired of Europe and anxious to get home.

Everywhere on my trip the rocks interested me even more than they had in my boyhood and my desire to know more about them increased. This was especially so at Rome, where the beautiful marbles and other stones in the ruins tantalized me. The guidebooks gave me their names and where they came from, but I wanted to know why they were so different and how they were made. Vesuvius was a wonder and delight for it was evidently a place where rocks were actually being made! There had been, a year or two before my visit, a great flow of lava, without the usual dust explosions, and the turmoil of black waves, like a petrified, stormy sea, was not covered up by ashes. One day, roaming over this rock sea, I met an Englishman chipping off little bits here and there with a hammer and spying eagerly at them through his pocket lens. I asked him some questions about the lava but could not get much out of him. He evidently knew enough but could not translate his knowledge into language I could understand. My questions probably revealed the depths of my ignorance, for he told me that, if I really wanted to learn about rocks, I would have to take a course in geology, which was a big subject. I determined to follow his advice as soon as I had a chance; but, when I got back to Boston, there were other things I wanted to do and it was nearly ten years before I carried out the plan and began a systematic study of geology at the Massachusetts Institute of Technology.

When I got to London, I was subpoenaed as a witness in a patent suit then going on between two English telephone companies. Through some oversight or bad legal advice, Bell's English patents did not protect his English company against infringers as his United States patents did our company. My fees for some expert work I did in the suit and the proceeds of the sale of another of my foreign patents were more than enough to pay the entire expenses of my trip. To him that hath! These legal matters kept me in England a few weeks longer than I had intended and gave me a chance to make a trip through the great shipyards of Scotland before I went on board the Cunarder *Scythia*, bound for New York. I had had enough of the steamers that ran at that time on the Boston route.

CHAPTER XXIII

MY voyage home was pleasanter than the voyage out, but, although the *Scythia* was a newer boat than the one I went to Europe in, I got a whiff occasionally of that deadly old-boat smell, with the usual distressing result. I had something of a shock when I reached the United States in May, 1882. I did not like the looks of the men on the streets. Gross, dull, stupid, sinister faces, slouchy attitudes, awkward gaits, repulsive voices, were startlingly common. It was depressing, for they did not look like men who could successfully carry on our great experiment in popular government.

I have often wondered why our men looked so bad to me when I came back. Is it because the people of each European country, being largely of one race, show in their street crowds a uniform type, pleasing to the eye of a visitor, while our people in the United States, being a mixture of many races, are unpleasingly heterogeneous in their general aspect, as men in uniforms are more pleasing to the eye than the same men in their everyday clothes? Or, is it that the more universal prosperity in our country brings out on our main streets persons who, in other countries, seldom leave their own section of a city? My talks with Frenchmen who were in Paris during the days of the Commune in 1871, suggested the latter idea. They told me that the most startling thing during those exciting days were the terrible faces of the men and women who filled the streets of Paris—types of human beings which they had never seen before except in nightmares. My first impression of our home crowds has never been as bad as that but I have had the feeling I have described, more or less vividly, every time I have returned from Europe, especially after a stay of a year or more. However, it always wears off after a few days and then our street crowds do not trouble me any more.

A cynical friend to whom I mentioned this curious home-returning feeling, asked me if the general appearance of the men on Boston streets was any better ten years before, when Williams' apprentices made part of the crowds. I think he wanted to intimate that my telephone dividends and my foreign trip had made me a little snobbish in my attitude toward my fellow citizens. That, perhaps, might have partially accounted for my impression, but it was not, I am sure, its only cause. But I have given all the theories that occur to me.

I had not the least desire to go back to telephone work and some testifying I did in one of our patent suits soon after my return, made it even more distasteful. The telephone business was still growing fast—it had not suffered any setback from my absence—but nothing in it attracted me. I knew I had had enough. I spent most of my time that summer reading, studying music, mathematics, Latin and French, building a house for my sister in Salem and selling the rest of my foreign patents. In September, 1882, I married Miss Elizabeth Seaver Kimball of Cohasset, Massachusetts, and went to California on my wedding trip, intending to stay there permanently but, although we passed a pleasant winter, we decided that the East suited us better and returned to Boston in March, 1883.

To be a farmer had been one of my boyhood dreams. On my western trip I became still more interested in agriculture and decided I would go into farming when I got back to Massachusetts, and see if I could not simplify and improve farm work as I had some of my machine-shop work. After a few weeks' search, I found my ideal farm in East Braintree, about twelve miles from Boston. It had a large house, which I suspected I should need before long; a good barn, several outbuildings, and sixty acres of beautiful land, sloping to the south, well divided into tillage, mowing and woods, and stretching for half a mile along the Weymouth Fore River, an arm of the sea. I bought it and went there to live in June, 1883.

Then, with the cocksureness of youth fresh from a successful achievement in another line, I started in to revolutionize farming. A year or two at the Agricultural College at Amherst would have been the wise thing for me to do, but it did not seem necessary then, for I had the popular belief that farming did not require any apprenticeship. I hired the old, hardworking farmer who had been on the place for many years and, after working with him a month or two, was sure I knew it all. I bought the newest farm machinery—mower, tedder, horse rake, sulky plow, harrows, cultivators, manure spreader, ensilage cutter, and a steam engine to run it, and built a ground marker so that all my planting could be exactly spaced. My farmer, however, did not receive my new schemes with the enthusiasm I had been accustomed to, for he much preferred his old tools and methods. In my machine-shop and telephone work, the natural order of events was some new method almost every day, but here on my farm the old ways suited my men best. After struggling a few months to revolutionize things I decided my farmer was justified in much of his opposition to my new tools and ideas, for my farm was too small and too rocky to work by machinery. My farming enthusiasm soon dying out, I let my men use the methods they preferred.

Perhaps the principal thing that killed my enthusiasm was my discovery that the hard work of digging, hoeing, haying, etc., was not so good for me as I had expected, for, instead of giving me a good appetite and making me sleep well, it had just the opposite effect. The natural result was that by the middle of autumn I had dropped most of the farm work and was spending much of my time in a little carpenter shop I fitted up in one of my buildings. This was more to my taste and I felt better, for my appetite and sleep returned. I always pitched into the farm work whenever it was necessary, but it invariably used me up. I never got hardened to it, although I tried it faithfully at intervals for several years.

I did not give all my time to manual work. The hunger to supply the deficiencies of my schooling was still strong. I bought a share in the Boston Athenæum and used that charming spot as my club. (The other clubs had so much tobacco smoke that I could not take any comfort in them.) I read all sorts of books there—those I devoured that year would fill a small library—and I kept up my studies.

But, although my time was well filled, I was not satisfied with my life. I missed the machine shop. I seldom passed one in Boston without getting permission to linger and watch the lathes and planers cutting metals into shape. One who wants anything as much as I wanted machine-shop work is likely to get it sooner or later, and I was in a receptive mood when, late that summer, an old friend, Joseph Dennett, the chief engineer of the Salem Waterworks pumping station, where I had spent some delightful days in my boyhood, brought me the drawings of a rotary steam engine invented by L. J. Wing of Lexington, Massachusetts, which Dennett considered to be a great invention. Becoming interested in it, I read up rotary steam engines for a few weeks and, finding Wing's engine was new in its principle, bought some stock in his company. One of the engines was being built in a Boston shop, where I carefully studied it that winter. It was finished the following spring but, testing it under steam, we found the need of further improvements and decided to build another to remedy its defects.

This was my opportunity to get back into my beloved machine-shop work and also to experiment with steam, which had been for years even more fascinating than electricity, so I contracted with the Wing Company to build the new engine myself. I fitted up one of my smaller farm buildings as a machine shop, hired a capable young machinist, Frank O. Wellington, to help me, and in the winter of 1884-85 began to construct the new engine in my own shop. Then I was happy for, in overalls again, I was spending my time in accurately shaping stubborn metal and feeling again the thrill of creating. We put our finest work into the engine, which in the spring of 1885 was finished and ready for its trial. But it was a total failure. In spite of our careful work its internal friction was very great and it could not be made steam-tight in some of its moving parts

After weeks of experimenting in the attempt to remedy these fundamental defects, I decided that they were irremediable and that it was useless to put any more money into the invention. I was sorry for Mr. Wing, for he was, of course, bitterly disappointed at my decision. However, our failure to make his engine work did not discourage him. He kept up the struggle to perfect his engine for many years and died without achieving success. I wonder if the faculty of knowing when your road has reached a dead end is not better than an over-developed perseverance that makes one waste his life trying to get through a stone wall instead of taking another road. I have often noticed such persistence in inventors.

But I had my machine shop in perfect running order and wanted to keep it going, for my desire to work on metals was as strong as ever and I also wanted to keep Wellington with me. So, canvassing the field to see what we could manufacture profitably we decided to build marine engines of sizes suitable for yachts and tug boats. It was a momentous decision, for from it came one of the largest shipbuilding establishments in the country, if not in the world, that made Massachusetts again a shipbuilding center and afterwards played an important part in the World War.

We soon got an order for a fifty horsepower steam engine for a small passenger boat that was being built to run on the coast of Maine, and started at once to make the drawings for it. I made Wellington my partner in the business, which we called the Fore River Engine Company, and we two did all the work, making the patterns, machining the parts, and erecting the engine. It was a delightful occupation. The machinery we built was larger and heavier than any I had made at Williams' shop and I felt that building steam engines was more of a man's job than much of my electrical work had been. Our engine, although of the usual reciprocating type, had some novel features in it, such as a radial valve gear, slow running boiler feed-pumps, etc., which with the careful workmanship we put into it, made it one of the best small marine engines that had ever been built in this country. It worked so smoothly and economically when we had it running in the boat that it gave our little shop a fine reputation and brought us at once other orders for engines. I preferred to keep the business small, but orders for engines came so fast that I had to hire more machinists and soon the little shop became so crowded with men and machinery that I had to build a larger one on my farm near the bank of the Fore River and equip it with power and tools for twenty to thirty men.

Besides my work as a machinist I also had to look after the bookkeeping, which had now become formidable. My training as a bookkeeper came handy. I started the books on the old plan of a separate cash book, journal and ledger, but there was too much unnecessary labor in that to suit me and it was too hard to get from it the definite figures that indicated whether my shop was making or losing money. The latter was important, for I wanted to make the business self-supporting as soon as possible. I gave the books, especially the cost accounting, much study, and finally devised a system which, using a separate card for each item of labor or material chargeable to either an engine part or a ledger account, reduced the writing and, consequently, the chance of error to a minimum. Most of the work of posting the books and determining the cost of an engine part was done by shuffling these cards into pigeon holes, summing them up at the end of each week and posting only the summaries. Two-thirds of the labor of keeping the accounts was the shuffling, which could be done by a boy.

For the general bookkeeping, I combined journal, cash book, and ledger into a many-columned book which I had specially ruled for my work. It eliminated much of the usual writing and was so simple that a trial balance meant little labor. I could have one at the end of each day if I wanted it.

My system worked so well that for months I easily did all the bookkeeping in addition to my work in the shop, getting from it the keen pleasure that I have always felt whenever I knew I was doing a job well with the least possible expenditure of energy.

As soon as I got the books to suit me I turned them over to a hired bookkeeper and spent more of my time in the shop. I need not go into the details of the work there, for, in such an old business as that of building steam engines, there is little to record of general interest. Compared with my exciting and novel telephone life, my engine work would seem to most people very commonplace. To me, however, the work was delightful, for it was the right combination of the inventive, the mental, and the manual to suit that period of my life. It was also satisfactory to know that, by bringing twenty or thirty skilled men into the place, I was contributing to the town's prosperity besides giving employment to some of the abundant unskilled labor of the region.

My partner, Frank Wellington, was one of the finest mechanics I have ever known, prolific in ideas, energetic and capable of carrying to successful completion the most difficult work. To his engineering ability is largely due the rapid growth of the business until it became an industry of almost national importance. I preferred to keep our work within moderate limits, but it increased so rapidly during the next few years that I found myself again in the position of supervising and doing little of the actual work in the shop or office.

CHAPTER XXIV

BY this time my desire for machine-shop work was quite satisfied and I was glad to have leisure for other things I had long wanted to go into. These were chiefly the science of human speech, and geology, the study of which subjects I now decided to take up in earnest.

As soon as I could delegate to others most of my shop work, I hunted up a teacher of elocution from whom, in a few months, I got a better idea of the capabilities of the voice than ever before. But by far my best discovery in this line was a book published in 1827, *The Philosophy of the Voice*, by Dr. James Rush of Philadelphia, from which I learned that expressive speech is governed by laws as definite as those of music, and came to realize that the reason why good readers are so much more scarce than good singers is that reading is an art more difficult than singing. Rush's book has been my text-book of the science of speech ever since I discovered it. I have found nothing to take its place. I have given much time for many years to the intensive study of the speaking voice along the lines of Dr. Rush's remarkable book and I have never found anything that gave more pleasure to myself and to others than the power

I got from it to understand and interpret the best in poetry and the drama. I am still keeping up the delightful work at 72.

But I did not give all my time to the study of speech, for geology was almost as fascinating to me. About 1890, soon after I began in earnest my study of the voice, my wife and I entered the geology class of the Lowell Institute under Professor Barton, beginning a study that has been one of the joys of my life. Graduating from this class two years later, we entered the Massachusetts Institute of Technology as special students in geology and paleontology, taking courses that lasted three years, mostly under Professor W. O. Crosby, under whose enthusiastic guidance the subjects broadened so rapidly that we soon found it necessary to take up other related sciences until geology became for us almost a "hub for the wheeled universe."

Although other things besides the general oversight of the shops required my attention, I had a glorious time studying during the next six or eight years. I have never regretted beginning college work at the age of nearly forty, for I am sure I had then an enjoyment and appreciation of it vastly greater than I should have had at the usual college age.

I have been asked, "What is the use of putting your time into all these things if you are not going to use them professionally?" Each science is the study of a way in which the infinite energy expresses itself in the universe and every attainment one makes in such knowledge carries him a little deeper into the divine mystery. Surely, no other justification is needed for such studies! And the work of the scientist searching for truth is true worship.

In a way I have used my acquirements professionally, for I have tried to share them both along geological and literary lines. At home or traveling, I have had the habit of looking up the salient points of the local geology, gathering rock specimens and putting the facts into an easily comprehended lecture, for which I have always found eager audiences of men and women as hungry for such knowledge as I had always been.

I have made some minor discoveries in the complex geology of Eastern Massachusetts, the most notable being the finding of some limestone boulders full of fossils in several places near Boston, where fossils are very scarce and eagerly sought for. In one of them Professor Grabau found a fossil gasteropod of Cambrian age, representing a new genus which he named "Watsonella." In Volume I of Professor Crosby's *Geology of the Boston Basin*, the most important book ever published on the geology of that region, I was glad to find the following words of commendation from him, one of the leading geologists of the country:

I also gladly embrace the opportunity which this supplement affords to acknowledge the important aid in the prosecution of this work which I have received during the year from Mr. T. A. Watson. He has not only made possible a great economy of my time while in the field; but he has proved himself an unusually acute and accurate observer with a ready and clear comprehension of the bearings of nearly every new fact; and my work has been at some points materially strengthened by the data and conclusions which he has freely placed at my disposal.

In the *Proceedings of the Boston Society of Natural History*, published in May, 1898, is the following, written by the curator, Dr. Alpheus Hyatt:

Professor Crosby, and in this the Society will most heartily join, desires to express his gratitude to Mr. Thomas A. Watson for his enthusiastic assistance and encouragement in the geological investigation of the Boston Basin. He has not only responded promptly and generously when money was needed, but has coöperated intellectually to the success of these investigations for a number of years. He has been urged to assume a share in the authorship, but having modestly declined, Professor Crosby wishes it to be clearly understood that he considers him to be justly entitled to a large part of the credit for whatever merit the work may possess.

CHAPTER XXV

ABOUT this time I came into contact with a young Congregational clergyman, Oliver Huckel, who was pastor of the principal church in East Braintree. He was the first minister I had ever met who did not remind me of the dreary Sundays of my boyhood. He was delightfully human and, if he had any plan for saving my soul, did not inflict it on me. A fine poet himself and a lover of good literature, he did me the great service of making me appreciate Walt Whitman and Robert Browning and the Greek dramatists. My intimacy with him stimulated my altruistic tendencies and it was largely through his influence that I established at this time the People's Institute of Weymouth and East Braintree.

I had been interested in the Boston Young Men's Christian Union for many years and, early in 1890, I discussed with Mr. Huckel the advisability of establishing a similar institution in our vicinity. He and others of our citizens becoming enthusiastic over the plan, I decided to try the experiment. I hired a building in Weymouth Square and fitted it up with parlor, reading, and game rooms and gymnasium. In connection with this I organized a course of entertainments and lectures, to be given in Dr. Huckel's church, hired teachers and started classes in elocution, penmanship, mechanical drawing, arithmetic, bookkeeping, and gymnastics. I called it "The People's Institute." It started with several hundred paying members. The lecture courses filled the church, and some of the classes had over a hundred members the first year. It was a great success for three years, then it began to die out, and in spite of my efforts, the membership at the end of the fourth year was so small that the directors decided it was not worth while to run it any longer. I had prepared plans for a building to house its activities but I never built it, for it soon became evident that the Institute was not a public necessity.

In 1889 my wife and I became interested in kindergartens, for two of our children were then old enough to begin such school work. We fitted up as a kindergarten the building where I first began the manufacture of steam engines, engaged a teacher, invited the parents of the neighborhood to send their children, and opened the school with a dozen pupils. It proved such a success that in a few years the town opened kindergartens in all sections as part of the regular school system, being the first town in New England to do this.

But I was not allowed to devote all my time to my private affairs. Beginning in 1891, a good share of my time for the next ten years was given to public work. Soon after we established our private kindergarten, the town appointed me chairman of a committee to study the needs for new buildings of the Braintree school system. When I read my report at the town meeting of 1891, an appropriation of twenty-five thousand dollars was given to my committee to construct the school building we had recommended. Soon after that one was finished, the same committee was instructed to design and build two other large school buildings in other sections of the town. Later, we supervised the remodeling of all the old school buildings and when we finished our work, the condition of every schoolhouse in our town was in accordance with the excellent laws of our State, which could not, at that time, be said of any other city or town in Massachusetts.

Next, I was elected a member of the School Board, which at their next meeting appointed me chairman, an office I held for many years. Then things began to pile up on me as usual.

When Edward Bellamy's book, *Looking Backward*, was published I became enthusiastic over the Utopia he described, for it seemed to solve the sociological problems that had troubled me ever since the financial success of the telephone had raised me to a plane of comfort and personal freedom so far above most of my fellowmen. I thought I had found in it a plan that would bring everybody up to my economic level.

With other enthusiasts, comprising writers, artists, poets, mechanics, and business men, we formed an association, calling ourselves "Nationalists." Nationalism became our religion. We believed with Bellamy that poverty and industrial strife would vanish if all industries were operated by the public for their own benefit. Private property was not to be abolished but in the happy prosperity that would come to all from the adoption of Bellamy's ideas no one would care to bother with owning things when doing his share of the nation's work for a few hours a day would give every comfort and luxury he could desire.

My love of better and simpler ways of doing things was at the bottom of my enthusiasm. I saw no insurmountable reason why the country's work could not be organized on Bellamy's fascinating plan and was sure my training and experience was just what was needed to start the new system going, for I had succeeded in everything I had undertaken up to that time and was at the age when nothing seems impossible.

I went into the movement energetically, taking part in many public meetings at which Bellamy and his followers spoke. We had fluent talkers in our ranks, but did not spend all our time talking. We induced the Massachusetts legislature to pass a law allowing cities and towns to build and operate their own electric lighting plants. Then I took up the matter with the citizens of my town of Braintree, which had no street lighting of any kind. They soon became as keen for it as I was and at the town meeting of March, 1892, appropriated the sum I estimated the plant would cost and appointed a committee, of which I was to be chairman, to construct an electric street lighting system.

Six months later, I, as manager of the plant, had it in operation, giving such satisfaction that the next town meeting made an appropriation to extend the plant to lighthouses, stores and factories. I had charge of this construction also, and four months later the house lighting extension was in operation. Several other towns in Massachusetts established municipal electric plants about the time we did, but my impression is that none of them has been as successful as Braintree's, which is still working well, thirty-five years later.

As the organ of the Nationalists, Bellamy established a weekly paper, *The New Nation*, which I kept alive, after it had exhausted Bellamy's resources, until 1894, when, paid subscriptions having fallen to the vanishing point, we stopped its publication. The People's Party put into its platform most of Bellamy's ideas and soon Nationalism as a separate organization, died out.

The pioneer work in the public operation of electric plants was my first and only attempt at practical socialism. A few years later I had seen so much of the inefficiency of government-operated functions that I have since been opposed to any extension of public ownership of industries. I am still interested in socialism as a philosophy, but before it can be successfully put into practice I fancy the forces of evolution must work an age or two longer on the spirit of man.

My activities in connection with Bellamy socialism giving me the reputation of a radical, barred me from state or national office under either of the regular political parties, although the Democrats nominated me for Massachusetts State Treasurer one year when there was no chance of their winning. I did not regret my defeat. I had all I could attend to in connection with my machine shops, the People's Institute, my studies, my work as chairman of the school committee, and as manager of the town's electric system. And the engine works were requiring more of my time, for I was taking steps to largely increase their activities.

CHAPTER XXVI

THE business of the region where I lived was largely shoemaking, and, about the middle of the 1890's, the people were seriously feeling the stress of the hard times then prevailing. The contrast between my lot in life and that of many of my neighbors had troubled me ever since I had lived there and in these times of general unemployment, the difference was more painful than ever. I tried to ease my conscience by gifts of money, coal, groceries, etc., to the sick and unfortunate of the vicinity but it seemed better to help by giving employment in our shop to as much of the unskilled labor of the region as we could use. To do this we had already increased our work by building the hulls of small vessels, as well as their machinery, and also by manufacturing printing presses and some newly-invented shoe machinery. But the hard times had cut down all branches of our business and by 1896 our shop had very little work to do.

In the midst of these hard times, the country having awakened to the necessity of building up our Navy, which had been at a low ebb for many years, Congress made a large appropriation for new naval construction, and among other warships the Navy

Department called for designs and bids for several torpedo-boat destroyers—which had never before been built in this country. These ships, being quite in our line, although larger, more complex and powerful than any we had yet built, seemed to offer an excellent opportunity to start our works going full speed and to increase their capacity so we could employ many more men. We at once started the designs for a destroyer. As soon as the drawings were finished we sent our bids to the Navy Department for two of them and a few months later were given the contract to build the two 400-ton destroyers—*Lawrence* and *Macdonough*—for $562,000.

This was the turning point in my life as well as in the destinies of the Fore River Engine Company. Before we decided to go into the construction of these ships, we had designed a steam automobile and had almost made up our minds to build them in our shops. Had we done so it would have made us pioneers in the automobile business. That might have been the wiser use to have made of our plant, but, as the destroyers seemed more in our line, we finally decided to build warships instead of "horseless carriages."

Although this decision was the beginning of the most difficult part of my life and led me into financial disaster, it was good for Eastern Massachusetts for, after we started on this new work, there was no lack of employment for many miles around. From our decision to build naval ships in 1897, made largely to give employment to more men, came the development of our little engine works into a great shipyard that, during the next twenty-five years, paid out more than $130,000,000 in wages, was a leading factor in the prosperity of Eastern Massachusetts and put our State back near the head of the column as a shipbuilding locality—a position it had lost during the Civil War. However, if we had decided to build automobiles, it might have made Massachusetts an automobile center and I certainly would have had an easier life for the ensuing ten years, and a larger income now. Who can say what's fit for us!

Before deciding to go into the exacting work of warship construction I figured out as well as I could (available data regarding shipbuilding in this country at that time was very meager) how much capital would be needed for the necessary increase in the capacity of our plant at East Braintree and to finance the construction of the destroyers. The estimated amount seemed well within my means but, realizing the importance of the step I was taking, as an additional safeguard I discussed my project with my financial friends in Boston, who assured me that if I needed more capital later than I was able to supply they could raise it for me by the sale of stock or bonds.

Signing the contract for the two destroyers started a wave of intense activity at the Fore River Engine

Company's works in East Braintree. At first, our work was largely getting ready to build the ships, that is, making the drawings, preparing the schedules for their raw material, constructing several large buildings, buying and installing heavier tools and machinery than we had ever had occasion to use, and hiring superintendents, foremen and mechanics for all departments, for our working force had to be largely increased.

But, three months later, we had made a good start on both the hulls and the machinery for the ships, notwithstanding all this preliminary work and the difficulty we had in finding the expert mechanics required for these delicately constructed and very powerful ships.

During 1899 both destroyers grew rapidly but our worries grew faster. We had unfortunately chosen, for the purpose of increasing our work, the most difficult construction in the whole of marine architecture. Every detail of a destroyer must be exquisitely exact in its design and construction and every ounce of material that goes into one must be of superquality. Several naval officers and their assistants were constantly on duty at our works, inspecting, testing, measuring, weighing every part of the hulls and machinery and condemning everything that did not fully conform to the naval standard of superexcellence.

It was the same with all the other shipbuilders who contracted to build destroyers when we did. None of us had ever had any experience in building such boats and every contractor found by the end of the first six months' work on them that the troubles that beset them came not as single spies but in battalions.

It gave me great pleasure to see the many interesting things going on in the shops, but I could not take the direct part in it I wished, for my duties as president and treasurer kept me closely confined to the office. I was obliged to enlarge the scope of my bookkeeping system, under which the works had run for fifteen years, but my plan of using detached cards for each item of material or labor that went into the ships, which could be shuffled into the various accounts, worked perfectly under the strain of our enlarged and more complicated business.

My chief anxiety was the constant call on me for money needed to build the additions to our plant and to finance the work until the payments from the government on the ships came in. Far more money was needed for this than we had estimated and there were many moments during the first year when I heartily regretted going into warships instead of automobiles. I began to think that it would have been cheaper and easier for me if I had pensioned all of the unemployed of my vicinity instead of taking on such a load of trouble and anxiety as my increase in the activities of the engine works—largely for my neighbors' benefit—had brought in its train. But there is no backing out when one starts a thing of this kind. It is like getting into the rapids of a great river; you are swept along, and all you can do is to try to keep in the middle of the stream and dodge the rocks.

Geology and poetry helped me keep afloat in the sea of troubles in which I struggled during these years. An occasional geological excursion with Professor Crosby for a few days, during which the shipyard was only a glimmer on the horizon, would send me back to work feeling able to cope with anything. And I could not have gone through these difficult years without Whitman, Browning and Emerson. A half-hour in the morning with one of these inspired minds made the day serene. Emerson's "Oversoul" has often cleared my vision so that I could peer through the fog of petty troubles and see what trifles they really were. Whitman's "Me Imperturbe" became part of me, and his "Song of Myself" often gave me courage and serenity. And Browning helped me often with such messages as this:

But what if I fail of my purpose here?
It is but to keep the nerves at strain,
To dry one's eyes and laugh at a fall,
And baffled, get up and begin again—
So the chase takes up one's life, that's all.

CHAPTER XXVII

A SHIPYARD has a ravenous maw for work and contracts for new ships must be fed to it in a steady stream or disorganization will result. Our workmen always sensed when work in the yard was getting short, and then would slow up on what they were doing, thereby increasing our costs and delaying the ships. To keep things booming, long before one ship is completed another must be started.

Work on a ship starts in the estimating department, where the figures are made on which the bids are based. After the contract is signed, the work flows in advancing waves through all the departments, one after the other, in a fairly regular order. These are: the purchasing department that buys the materials, the designing rooms where the details of the hull and machinery are wrought out on paper; the mold loft where the lines of the hull, the shapes of the frames and of other parts of the hull, are drawn out full size; the pattern shops where the wooden patterns are fashioned for the metal castings; the departments of hull construction where the frames are bent, the plates are shaped and punched, and the riveting and caulking are done; the forges; the machine shops; sheet metal shops;

woodworking shops; erecting shops, where the machinery is set up ready for the ship; and many important minor departments, such as oil tempering and annealing furnaces, galvanizing tanks, piping shops, etc. And interlaced with all these activities are the office forces in charge of pay roll, stock rooms, cost accounting, and general bookkeeping, all of them trained men and women who must also be kept busy.

To keep all our departments busy it was necessary to get another ship to build as soon as the destroyers were well started. There was no demand for commercial ships and our only customer was again the United States Government. The Lighthouse Board wanted a powerful lightship for Cape Hatteras. As its size was within the capacity of our plant, we bid on it and it was awarded to us in June, 1899.

When the lightship was well under way in its construction and we needed another ship to build to avoid a shutdown in some departments, we were brought face to face with a serious fact. There was no further demand for ships of the size we had fitted up our East Braintree plant to build, and it soon became evident we should have to discharge many of the skilled men we had had so much trouble to find or construct a yard on deeper water capable of building much larger ships. When the necessity arose for making this decision, I felt the rapids I was in running very violently. But our enterprise was too important to the welfare of the community to let it fail, so as the Navy Department was asking for bids on some unarmored cruisers we decided we must get one of them, if possible, although we knew that to construct it we should have to build a larger shipyard. We put in our bid, and in November, 1899, the 3,000-ton cruiser, *Des Moines*, was awarded to us for $1,065,000.

Then, with the confidence of one who had never yet failed in anything important he had attempted and who needed, perhaps, to have the conceit taken out of him, I started in to build with my own capital the largest shipyard in the United States, capable of constructing any ship that might offer.

I bought one hundred acres of waterfront land at Quincy Point, which was fortunately in the market and which I knew, from my previous geological study of the region, was perfectly adapted for our purpose. It was the dry gravel of a glacial delta, firm enough to bear any weight we might put upon it, easily excavated, without any ledge and with sufficient depth of water easily obtainable to float the largest vessels. We were not much troubled by the fact that the bridge between us and the sea had a draw too narrow to let the cruiser through, for the public interest in our enterprise was so great that we were sure we could get the county to build another bridge with a wider draw long before we could finish that ship.

Then, while the difficult work on the destroyers and the other craft was going on at our East Braintree yard, we started the construction of a shipyard at Quincy Point in which we could build as large a ship as any of our competitors, organizing an army of men to excavate, dredge, build wharves, a dozen large buildings, ship ways and overhead structures, lay railroad tracks, buy and install colossal machine-shop and ship tools, move the tools and buildings from our old plant, and do a thousand other things a shipyard requires.

It was a tremendous job that was not fully completed for four or five years, but Wellington, who carried the engineering burden, was equal to it. I thought I had had as great a load as I could bear at East Braintree, but that was nothing compared with what was on me now. The demand for money quadrupled, and realizing that the amount needed would probably be beyond my power to supply, I notified my financial friends that I might be calling on them for help before the year was out. But the work on our ships went on rapidly and several times when it seemed to me that I was at the end of my resources, a big payment would come in and the atmosphere would be less blue for a while.

Our record for the year 1900 is a fair illustration of the way the work in the yards progressed. In January of that year our two destroyers were about half completed. In February, we were bending the frames for the lightship. In May our drawings for the cruiser were well along and there was much material for it in the yard. In June and July some of the larger shops at the new shipyard being finished we had men at work in them and a long stretch of our new wharf was completed. In September we launched the lightship at East Braintree and took her down to the new yard for completion. In October we laid the keel of the cruiser *Des Moines* at Quincy Point and had its engines well advanced. In November we launched one destroyer at the East Braintree yard and took her to the new yard. Our weekly pay roll had then increased to $6,500. December was specially eventful. Needing more work in our drafting rooms, we bid on two battleships for the United States Navy. We put a four-story office building on scows and floated it from East Braintree two miles down the river and set it on its foundation at our Quincy Point yard without interrupting work in it. We launched the other destroyer and took her down to Quincy Point. We were notified by the Navy Department that the contract for two 14,600-ton armored battleships would be awarded to us for $6,810,000 as soon as we incorporated our business. We began to purchase the land over which to run a standard gauge railroad three miles long connecting our new shipyard with the main line of the N. Y., N. H. and H. R. R. at

East Braintree. And 1900 was only an average year in my shipbuilding experience.

Up to this time Wellington and I had kept the Fore River Engine Company as a partnership between us, although we had realized for some time we should soon have to turn it into a stock company. The Navy Department obliged us to do this at once when they gave us the contract for the battleships. Our lawyers advised a New Jersey charter. We applied for one under the name of The Fore River Ship and Engine Company, with an authorized capital of $6,500,000. It was granted in February, 1901, and immediately after, I, as president of the new company, signed the contract with the Navy Department for the two battleships, *Rhode Island* and *New Jersey*, transferring to the new company all the assets and contracts of the Fore River Engine Company.

I was president of the new company and George W. Davenport became its treasurer. It was a relief to get rid of the office work, but I had to keep on selling my telephone stock and other securities to supply the capital needed for the construction of the Quincy Point plant. It is perhaps an indication of the load we were all carrying at that time that our new treasurer broke down after a few months and had to go to a sanitarium. When he recovered he wisely took a less strenuous position, but he died a year or two later.

All the shipbuilders in the United States at that time were carrying an overload of work and anxiety just as we were. Soon after our treasurer went to pieces, I came into contact with another tragedy among the overworked shipbuilding leaders. One day, after an anxious conference of shipbuilders in New York, I was walking up Wall Street with Henry G. Morse, president of the New York Shipbuilding Company, discussing the troubles besetting American shipbuilding, when he suddenly grasped my arm and begged me to take him to some place where he could lie down. I supported him back to the Morgan office and put him on a couch in a private room, where he became unconscious. The doctor I called did all he could for him, but he was dead before the ambulance got there.

We had now all the naval work we cared to undertake, but to balance our load with less exacting work we wanted to get some merchant ships to build, hoping to make that class of work the main product of our yard as soon as we could get enough of it.

We designed for John Crowley of Boston an enormous steel schooner with seven masts, capable of carrying a load of seven thousand tons of coal and, soon after the two battleships were awarded to us, we contracted with Mr. Crowley to build this schooner for $240,000. Notwithstanding its great size, it was so much simpler than a warship we were able to finish it while the preliminary work of the battleships was being done. The schooner, which was named *Thomas W. Lawson*, was the largest schooner that had ever been built and the only vessel with seven masts the world has ever seen. It was a glorious sight as she went to sea under full sail. She made many profitable voyages carrying coal from southern ports to Boston. Even in a very light wind few freight steamers could beat her. We were proud of the supership and felt it a personal loss when, a few years later, she was driven ashore in a great storm on the Scilly Islands and totally wrecked.

The seven-master was so simple and easy to build, compared with a warship with its vast complexity, that after it was launched I gave much of my time to getting contracts for merchant ships. There was little demand for them, but we got our share and during the next two years most of our new contracts were for such vessels.

Soon after the *Lawson* was launched we laid the keel of another steel schooner, the *William L. Douglas*, nearly as large, but with six masts instead of seven. Later, we built several steel freight car floats for use in New York harbor, the first ever built of steel in this country if not in the world. Then we built two Fall River liners—the *Providence*, a passenger boat, and the *Boston*, a freighter. We also built for the county the new Quincy Point bridge with its many spans and a hundred-foot draw. This was seemingly out of our line, but we built the drawbridge section on ways like a ship, launched it on scows and, floating it at high tide to its place, let the falling tide deposit it in its position on the pier.

These constructions and a few smaller vessels served to fill the chinks of our colossal work on the warships. In 1902 we had eleven ships under construction representing contracts of more than twenty million dollars. On my tours of inspection through our works, more than ever before, I felt the creation-thrill as I saw those superb ships on their ways and their titanic engines in the shops all growing rapidly toward completion. Looking at these tremendous structures representing the highest inventive, engineering, and mechanical skill of mankind, I felt that in the entire list of human industries there is none comparable in grandeur with the building of a ship. At these moments the business aspect of the works seemed a trifle. I lived in an epic poem.

And, as I look back twenty-five years later, on my shipbuilding days, its poetry is still so superb in my memory that, in spite of the tragic elements mingling with it—anxieties, losses, deaths—I cannot regret that this great experience was mine.

CHAPTER XXVIII

THE eleven ships we were building were of nine different types, covering almost the entire range of modern naval architecture. This heterogeneity greatly increased the difficulty of our work, but we had to take such a variety, for in the moribund condition of the United States merchant marine, no shipyard could keep busy unless it built all of the kinds of warships and commercial craft that offered. There were not enough ships of one type being built in the entire country to keep a single large yard going.

This has been, and still is, one of the handicaps of American shipbuilders. Only a yard building the same type of ship over and over again, can use the labor-saving methods which have enabled us, in other lines of industry, to compete with the world in spite of the fact that American wages are so much higher than those of other countries. If the United States had had a prosperous and growing merchant marine requiring a constant supply of new ships, it would have been possible for our shipyards to specialize on a single type and by manufacturing them reduce their cost to a figure approximating that of ships built in foreign countries, notwithstanding our high scale of wages. Could we have done this in 1900, the story of American shipbuilding might have been a tale of triumphant achievement and not such a doleful account of struggle and poverty.

United States shipyards were then, and still are, struggling under this handicap. And the Fore River Ship and Engine Company had not only the troubles common to the others but also the difficulties, delays and expenditures arising from the necessity we were under of constructing our great plant and organizing a new personnel while we were building some of the largest ships that had ever been built in this country.

These considerations, and my efforts to get profitable contracts for building merchant ships, brought me face to face with the problem of reviving our merchant marine. It soon became evident to me that only by solving that problem could our shipyards get enough profitable work to keep them busy.

The decline of American shipping was largely due to the fact that, since the Civil War, our money and energies had been employed in building railroads and developing our other great internal resources. For this reason we lost our interest in the sea and allowed other nations to carry on our foreign trade until, at the time of my shipbuilding experience, American shipping had fallen to such a low ebb that a merchant ship flying our flag was rarely seen in a foreign port although, a few decades before, our ships had covered the seven seas, leading the world in speed, efficiency and enterprise.

The revival of our merchant marine was obviously a question of protecting our foreign shipping against the swarming ships of other nations by a tariff or a subsidy. Other American industries were protected from foreign competition by a tariff on goods imported into the United States but, strangely enough, our ships engaged in foreign trade had been left unprotected. Foreign ships, costing much less than ours to build and to operate, were allowed to bring our imports to us or carry our exports away in free competition with ships built by our mechanics and operated by sailors receiving the high wages of a protected country.

If any other American industry, paying its employees American wages, had been left unprotected by our tariff laws, that industry would inevitably have been killed, as our merchant marine had been. Coastwise traffic in the United States was flourishing because it was protected against foreign competition by our laws forbidding foreign ships under heavy penalty to trade between United States ports, but any foreign ship could carry freight or passengers from foreign ports to ours, or the reverse, in absolutely free competition with our costly ships paying American wages.

Competition was impossible under such conditions. United States ships, of course, disappeared from the seas and the few shipyards this country could support had to depend for their living on government work or on the few ships needed for coastwise trade. It was a precarious living, for the requirements of government ships were so onerous that the estimated profits on them often vanished before such a ship was finished and there were not enough coastwise ships being built to keep a single large shipyard at work. The few shipyards in the United States in 1900—the number is not much larger to-day, twenty-six years later—was a sufficient indication of the low state of American shipbuilding. If the merchant marine of the United States, with its thousands of miles of coast line, had been flourishing as that of England, as it certainly should have been, a hundred shipbuilding establishments larger even than the Fore River Ship and Engine Company would have been needed to supply the demand for American ships.

In the early 1900's, the shipbuilders and shipowners were trying hard to find a remedy for this state of affairs. They could not ask American ship mechanics and sailors to work for the wages and under the conditions that prevailed in other countries. That would have been absurd! Certain treaties prevented our taxing freight and passengers carried in foreign ships to or from the United States. There seemed no other way out of the difficulty except through a subsidy, so, all of us who were interested entered vigorously into a campaign to obtain one from Congress. Much of my time during the next three years was spent in the struggle to get a subsidy sufficient to enable our ships to compete with foreign ships.

But all our efforts were in vain. The opposition referred to us as wealthy plutocrats who were pushing a nefarious scheme for bleeding the public. The people of the West hated the very name of subsidy and their senators and representatives killed the measure when it was introduced into Congress.

Recognizing the impossibility of accomplishing their object in the face of such strong opposition, our shipbuilders and shipowners, who had been trying to put American shipping on the same basis as other American industries, gave up the fight and the matter drifted until the exigencies of the World War hurled our nation into the building of ships in such frantic haste, necessitated by the scarcity of American ships and shipbuilders, that it cost the country vastly more than a most liberal subsidy could have amounted to, even if it had been continued during the fifteen years intervening between our subsidy efforts of 1903 and the German submarine depredations of 1916-17.

It was with melancholy interest that, on the day I wrote the above lines referring to our subsidy struggle of 1903, I read an article in the *Boston Evening*

Transcript of March 20, 1923, which indicated that the prospects for an American merchant marine are not any brighter to-day than they were twenty years ago. It is a pity, for without a multitude of American ships trading to all parts of the world, our youth cannot have the finest, manliest, and most wholesome of all training—that of deep-sea navigation.

CHAPTER XXIX

THE two destroyers were finished early in 1901. They had their trials and ran very well up to a speed of twenty-six knots an hour, but, at that speed, the engines shook the boat so violently that we did not dare to run any faster. The cause was sympathetic vibration. It was the second time it had come into my life, for it was the principle of Bell's harmonic telegraph that I had struggled with him to perfect twenty-five years before. In Bell's apparatus I was using an infinitesimal power; now I was dealing with sympathetic vibration acting through hundreds of horse power. The pulsations of the destroyer engines when the boat was running at twenty-six knots happened to correspond exactly to the rate of torsional vibration of the boat's propeller shafts, so that, at that speed, when the engines were developing more than two thousand horse power, these two vibrations reinforced each other in a vicious circle, shaking the boat with such a constantly increasing violence that an attempt to run it faster would have wrecked it. It was one of the difficulties likely to arise in building for the first time a ship so light in weight and so very powerful. All the other contractors for destroyers had the same trouble. We remedied it in our boats by changing the vibratory rates of the engines and propeller shafts so that they did not reinforce each other, but succeeded in doing so only after months of costly experimenting. It was a great relief when these troubles were straightened out and the two destroyers, *Lawrence* and *Macdonough*, delivered to the government. They were active ships in the United States Navy for many years and played an important part in the World War.

The public was interested in our new shipyard and many articles were published describing and illustrating our plant. The immense amount of work we were doing and the interesting operations connected with the great ships, some of them of a type never before built, brought many prominent engineers and business men to inspect our works. They were anxious days for me, for I still had to find the money to supply the capital needed to complete the shipyard and make the extensions required by our contracts. I bore this burden alone for three years for the brokers, who had been so sure they could help me when the need came, one by one withdrew, evidently scared by the magnitude of our work and its unusual character, although our books, which were verified periodically by public accountants, showed a good profit. At the height of this financial pressure our treasurer broke down, throwing an additional burden on me. And to this burden of work and worry was added the greatest grief of my life, for my two sons died after long and hopeless sicknesses, one in 1901, and the other two years later.

Some of our treasury stock was sold but the amount realized was altogether inadequate for our needs and when, in the autumn of 1902, some Boston men who were interested in the enterprise came to the rescue and offered to underwrite a million and a quarter dollars of our 6 per cent bonds, receiving for their services a large bonus in our preferred stock, I was glad to accept for I could raise no more money myself and the need of the Company for additional capital was so great that disaster threatened the enterprise. Part of the agreement with the bondholders was that they should be allowed to name a majority of our board of directors and also to put in their own treasurer and I agreed to resign as president of the Company if at any time they wanted to put their own man in my place. These were hard terms on which to raise an inadequate sum of money (one of the other large shipyards, longer established but not so large as ours, floated a loan at that time of seven million dollars), but I had to accept or see the whole business scrapped.

The sale of our bonds put the Fore River Ship and Engine Company temporarily in a strong position financially, but the new board of directors soon showed me that I was no longer in control of the Company's affairs. One of its first actions was to suspend dividends on the Company's stock. But, although this aroused a storm of protest, the directors were firm in their judgment that the Company should pay no more dividends until the plant was finished and paid for. This was undoubtedly a wise decision, but I did not think so at the time. But I had to acquiesce, although it deprived me of most of my income, for practically all of my property had been turned into Fore River stock. But I had little time to think about it, for the demands of the Company's work on my time were more insistent than ever and another vital matter was just then claiming my attention. This was securing the rest of the land needed for the railroad to connect our shipyard with the main line of the N. Y., N. H. and H. R. R.

Up to 1903 our material had been brought into our yard by steam lighters and trucks. This was slow and expensive and, from the beginning of our work at Quincy Point, we had been studying the question of a branch railroad to our plant. The railroad company refused to build it for us, although they would make the connections if we brought our branch to their line. It was evident that we must do it ourselves. We had considered several routes but found none of them practicable until we discovered a way through a rocky valley by which we could reach with easy grades the main line, about three miles away. Most of the route was over cheap land which we could buy at a reasonable price, but a few feet of it passed through the edge of a wealthy man's estate, who would not sell an inch nor grant us a right of way, although he made no use of the property. He held us up for more than a year, but in 1902 our branch railroad had become an absolute necessity and it was evident we must have the right of way through that estate at any cost. I again took the matter up with the owner, and after long negotiation he finally told me that the only way we could get our railroad over his land was to buy his entire estate for forty thousand dollars. I had to accept, for trucks and lighters could no longer transport our material as fast as we needed it.

As soon as this land was secured, we rushed through the construction of our branch railroad and had it in operation in June, 1903. It was a great relief for us, for it accelerated the work on the ships and decreased the cost of transporting the thousands of tons of heavy material pouring into our yard.

My notebooks during these years record some bitter thoughts regarding a few men who held us up, until they had bled us to the limit, in our work of building an industry on which the prosperity of the people of that section of Massachusetts depended. And none of these thoughts show any deeper disgust with our treatment than those relating to the construction of our branch railroad.

This was the time of my greatest activity in helping to get the subsidy bill before Congress. And there was another important matter that, arising at that time, also kept me in New York and Washington a good deal. Many important and necessary changes had been made by the Navy Department in the designs of the destroyers during their construction. This had entailed on all the contractors for these boats serious delays and expenditures for which they claimed they had never been adequately compensated. In 1902, as soon as the boats were completed, or nearly so, I called a meeting of the contractors to take action regarding this extra compensation which, at a reasonable estimate, amounted to a total of several million dollars. The Navy Department agreed that we were entitled to extra payment and appointed a board to determine its amount. We took up the matter with the board and got our claims before Congress a year later. But we might have saved our labor, for our claims were promptly pigeonholed. Perhaps, in a century or two the contractors' heirs may get part of what was due us, but it is not likely.

In the spring of 1903 all the ships we had under construction were so well along that we needed another big ship to keep our beginning departments at work. I tried hard to find some one who wanted a big merchant ship or two. Our beggared merchant marine did not have any use for such a thing and our coastwise steamship lines were not in the market for ships. The Navy Department, however, was asking for bids on some more battleships and we decided that our shipyard must have one to keep things going. I had charge of the bidding and in June, 1903, the battleship *Vermont* was awarded to us for $4,179,000.

This was the last big event in the affairs of the Fore River Ship and Engine Company with which I was concerned. Our new directors had for several months been getting more and more alarmed at the magnitude of our work and the need of the Company for more capital and were trying to cut everything down to the limit. It had become evident to them that the money received from the sale of our bonds was not enough for the Company's needs and that a million or two more must be raised. The bondholders did not want to put any more money into the business and their directors, who were a majority of the board, were doing their best to avoid the necessity. Dividends had been stopped and now they stopped all expenditures on plant construction that were not imperatively needed. In September, 1903, they ordered Wellington to discharge five hundred men, which he did, although our yard was crowded with work and needed every man.

Of course, our officials and their methods of work, from the president down, were under criticism. I believed much of the criticism was unjust and to answer it made some investigations comparing the efficiency of our plant with that of other large United States shipyards doing the same class of work. I was satisfied by what I found that our yard in spite of its newness and incompleteness was doing as much and as good work as the other yards and with fewer men. I presented my facts to the directors, but to no avail, for they had evidently decided on a drastic reorganization.

Naturally, the first step toward reorganization would be a new president. I was willing to let some one else try my job. My resignation had virtually been on file with the directors since the sale of our bonds in 1902. They decided that Admiral Francis T. Bowles, chief constructor of the United States Navy Department, was the right man for the place and in October, 1903, elected him president of the Company, electing me chairman of the directors. I was pleased with their choice for president and felt that the Company was lucky to get such a man for the colossal task.

I turned over to the new president all the Company's affairs I had in my immediate charge and, a few months later, I also resigned my sinecure as chairman of the directors, which marked my final exit from the shipbuilding drama. I had started the business twenty-two years before in my little kindergarten building, with a single helper, and left it with a plant covering with its great structures a hundred acres and employing four thousand men on a pay roll of many millions of dollars a year.

The next step in the reorganization was the foreclosure of the bondholders' mortgage which rendered the stock of the Fore River Ship and Engine Company valueless and wiped out my entire investment in it, but I had become so hardened to calamities that my distress over my personal loss was small. I realized that although my loss was much larger than that of all the other stockholders together, it was a trifle compared with the benefit to the community that had come from my enterprise.

Under the leadership of Admiral Bowles the shipbuilding enterprise at Quincy Point increased its activities. Many large naval and commercial vessels and most of the submarines built in this country have been constructed there since I left it. Just before the World War the plant was sold to the Bethlehem Steel Company, which has carried it on since. The war brought an enormous increase in its work and in 1919 it employed twenty thousand men with an annual pay roll of over thirty-three million dollars. When the United States entered the war the Fore River Company represented a large fraction of the entire shipbuilding capacity of our country and was, for that reason, an important part of the contribution of the United States towards winning the war.

CHAPTER XXX

FOR a while I was dazed at this great change in my life that ended my shipbuilding "incarnation," but soon I went back to my books and my beloved rocks with a sense of freedom that I had not had for years.

Before I started building warships, realizing the risk of such a venture, to protect my family against contingencies, I arranged a small trust fund from which only the income could be drawn. At the time it seemed an unnecessary precaution, but seven years later, when my salary and dividends from the Fore River Company stopped, I was glad I had done so. I increased my sadly reduced income by public readings of poetry and plays, work that I loved, which indeed absorbed much of my time for several years.

I also made some practical use of my geological knowledge in hunting for profitable mines to sell, or work, at profit. I took Professor Crosby into partnership and we had some delightful experiences studying mines and ore prospects. One of the most interesting propositions we found was a gold mine in Juneau, Alaska, which the owner had offered to us for fifty thousand dollars. As it seemed promising, we spent a summer studying it and the adjacent water powers. Such work certainly is a man's job. It means the determination of the amount of ore in the property, its value per ton, the cost of mining and milling it, whether the rock would require expensive timbering, whether it would need much pumping to keep the mine dry, whether there was sufficient water power available, and many other points.

At first it looked favorable, for the ore body certainly had millions of dollars' worth of gold in it, but we soon found the gold was so thinly distributed through the very hard rock, it would not pay the cost of getting it out. We studied the property carefully—one does not lightly refuse to buy millions of gold for fifty thousand dollars—but we finally decided not to purchase. When we told the owner of our decision, he offered it to us for half that price, but even that did not tempt us, for a mine that requires the expenditure of $1.25 to get one dollar is dear at any price.

The ore body in this property outcropped on the top of the highest mountain near Juneau. Its examination required a good deal of climbing to heights that commanded superb views of mountains, valleys, glaciers and seas. In this part of our work I took as much interest in the scenery as I did in the minerals.

I had a delightful feeling of opulence that summer while we held the option on all that gold, and was disappointed when we found it was out of our reach. Unless cheaper methods of concentrating low grade ores are found than we now have, we must wait a few million years until sun and frost smash the solid rock that now holds this gold so tightly, into a pile of gravel from which the gold may easily be washed. Then, if the fascinating yellow metal is still of value to mankind, there may be another Klondike rush to get it. But when that time comes I fancy I shall have no further need nor desire for a larger income or for anything else material.

After we finished our work in Juneau, I went by a decrepit little steamer as far west as Kodiak Island, stopping for a short time at most of the important places along the southern coast of Alaska. Then back over the same route to our starting point, Seattle.

My summer in Alaska did not directly increase my income, but it paid big dividends in health, in enjoyment of scenic beauty seen from unusual points of view, in geological knowledge, and in mental stimulation from contact with some fine types of men and women new to me. Soon after I got home I wrote an account of this trip which I delivered as a lecture many times during the next two years.

On this trip I put into shape an old idea of mine for a plan of coöperative industry that would, I believe, harmonize the interests not only of capital and labor but also that of the consumer, whose welfare is usually neglected. Its essential feature is the inclusion in boards of directors of public utility corporations of representatives of the employees of the company, and of the general public. The *New York Sun* published my plan in 1907 and commented on it favorably in an editorial. Later, it was one of my lectures, and I afterwards put it into a pamphlet.

The trip to Alaska was one of several that Professor Crosby and I made in our search for a paying mine. We made another notable one, examining some copper-bearing veins outcropping for miles in the mountains of Southern California, near Death Valley. We met the prospectors who had discovered the ore and wanted to sell us their claims, at Keeler, California, in the middle of December and went with them on horseback with a pack train of eighteen animals far into the heart of the desert mountains of that region, where white men seldom go. It was fascinating work, climbing and riding all day in that beautiful region and sleeping under the stars at night, but we did not buy the claims for the ore bodies were inaccessible and their copper value low.

We had many such experiences while we were hunting for a profitable mine, but we found very few that tempted us to purchase. Our judgment must have been good, for I have never heard that any of the mines or prospects we then rejected have ever since been worked profitably, although much money has been sunk in attempts to do so with some of them.

In all our gold mine examination it was necessary to keep a sharp lookout for the devices sometimes used by prospectors and mine owners to increase the apparent amount of gold in the ore body they wanted to sell us. Cases have been known where a shotgun has been loaded with gold dust and then fired into the face of the ore body, from which the intending buyer was to take his samples. The knowing purchaser always takes his samples from a fresh face exposed by blasting or picking while he is in the mine. Even when a fair sample of the average of the ore has been obtained, it is well to keep a sharp eye on it while it is being pulverized for the assayer. The laborer who does such work is sometimes bribed to chew tobacco from a plug heavily charged with gold dust and expectorate into the ore he is pounding. This is an efficient device for increasing values for it does not take much gold dust to make a showing in a small bag of ore. Tightly sealed canvas bags, filled with the ore honestly pounded, can not be safely left unwatched in transportation, for a hypodermic syringe can inject enough gold solution into a bag to make its value in precious metal much higher than it was when it came from the mine. Other ways that are dark can be used to deceive the unsuspecting mine purchaser if he does not watch out. Professor Crosby had learned by long experience to guard against these deceptions and in our work together I never knew a miner successfully to play any tricks on him.

I certainly did not lack occupation after I left shipbuilding. My time was filled with straightening out my personal affairs, mine explorations, geological work, lectures, and readings, my old studies, and some new ones in painting and music.

On my trip to Europe twenty-five years before I did not get the pleasure I expected from the famous works of art in the museums I visited almost every day and was puzzled and depressed by my lack of appreciation. I decided that the reason for this was that I had had no artistic training in my previous life. The most lasting good I got from that first trip abroad was that it revealed my cultural deficiencies and increased my desire to remedy them.

When I returned from that first trip I tried to find some one who could guide me to a more intelligent enjoyment of artistic things. I found those who could teach me to draw, paint or model in clay, but I did not want that. I wanted some one who could teach me to understand and enjoy the best works of art, but there did not seem to be such teachers and I could not get much from the books I read on the subject. During my shipbuilding days I was obliged to let the matter rest, but after the close of that part of my life I found such a teacher, and my wife and I took a course in what might be called laboratory work in Renaissance art, using for the work photographs and the pictures and casts in the Boston and Cambridge museums, opening thereby a new world of enjoyment. Later, we continued the delightful work by joining with our two daughters a party of students who were going abroad to study art, and with them visited the museums, galleries, churches and ruins of England, France, Italy, Sicily and Greece. It was a strenuous trip covering a vast field, but a delight from beginning to end.

Another new study I took up in the years after I left shipbuilding was music appreciation. Just before I left the telephone business, I tried to conquer the art of piano playing, but decided I was too old to learn to play well. I hadn't worked at it long before it struck me that I and a good many others with no musical talent were spending our time and exhausting our neighbors' nerves trying to become players when a course in music appreciation was what we really needed. That kind of music teaching was unknown in the 1880's but the improvement of the mechanical piano that came, twenty-five years later, gave the opportunity I wanted. I bought a pianola, a systematic collection of music rolls covering the principal compositions of Haydn, Mozart, Beethoven and Wagner, and some books about them. A year of this made the principal works of these masters familiar to me, and greatly increased my enjoyment of music.

I had many opportunities to go into business again, but none of them tempted me. I had had enough of that sort of thing. In fact, unconsciously but surely I was swinging into a third period of my life, its devotion exclusively to cultural studies.

CHAPTER XXXI

BY the beginning of 1910 the study of the speaking voice, as a means for arousing in others a love for poetry and the drama having superseded all my other occupations, I was seeking some means for further progress in what seemed to me the most subtle of all arts, that of human speech, and, reading an account of the work Frank R. Benson's Company of Shakespearean Players was doing in England, it occurred to me that association with such a group, if I could arrange it, would give me what I needed.

Mr. Benson was at this time about fifty years old; he was a graduate of Oxford, where he was noted for his athletic prowess. He became interested in the theater soon after he left the university and played for a time with Henry Irving, but soon put his own company on the road. He had three companies touring England, Ireland and Scotland. His number one company had about fifty people in it and played in the large cities only. The repertory of his companies was largely Shakespearean. He had been doing this work for nearly twenty-five years largely because he believed it to be a practical means of raising humanity to a higher plane. In connection with his largest company, he took each year a few young men and women as students of acting who did practical work on the stage in his plays, either in the crowd or in small parts. The stage work of Benson's crowd was so well done that it was quite famous in England and many of the leading English actors had served their apprenticeship in it.

In the summer of 1910 I wrote to Mr. Benson asking him whether a man of my age, without stage experience, would be received as a student in his Company. He replied:

> It is not usual for us to take men of your mature years, and we think it unlikely that at your age you will be able to obtain lucrative engagements, but if you are not risking your all in joining us, you will be welcomed and will, I am sure, find the work interesting and beneficial.

All I should risk was my dignity and, feeling sure that was not of sufficient importance to cause me to forego this fine chance for advancement in my beloved art of speech, I decided I would turn boy again—as far as my years would let me—and join Mr. Benson's company in England as a student, a decision that resulted in one of the most delightful years of my life.

The study of speech was my object, but the idea of getting an entirely new experience also fascinated me. I am sure I was not stagestruck. At fifty-six the heydey in the blood is too tame for that—or ought to be. But if I had been a little stagestruck I should not be ashamed of it for the desire of most of us to act is a creative impulse and a touch in us of God himself. He incarnates Himself in the unnumbered forms we know, animate and inanimate, and we—atoms of God—feel the divine process in our desire to act, which means, to incarnate ourselves in other lives than our own. Our acting is not all done on the stage. Most of us are acting a part in our daily lives, for the kind of person one shows to the world is quite unlike his real self, which he keeps out of sight most of the time. Indeed, maybe if we were not so successful in doing this, some of us might have but few friends!

Soon after I arrived in London I had an interview with Mr. Benson's manager, which convinced me that I was doing a good thing in joining his company. I made the final arrangements, and was told that I would soon be notified of the time and place for the beginning of rehearsals.

I spent a few days getting my wife settled in London, at a house where one of her English friends lived, and in helping her select some courses at London University on Renaïssance Art, Medieval Architecture, Old Buildings of London, and Egyptology, to occupy her time while I was roaming through the Provinces with the players.

One morning I had a real thrill when I received by mail from the manager a third-class ticket to Bath, with a note telling me to report at the Theater Royal in that city on September 23. It marked the beginning of this new life for me—to which, however, I was looking forward with some apprehension.

With my English stage experience were associated many things outside the theater—walks on the delightful English footpaths, visits to picture galleries, churches and ruins, studies of the local geology, inspection of shipyards, and other matters in which I was interested. My tours with Benson's company gave me many opportunities for such things in places tourists seldom visit. Few of the other members of the company cared for sightseeing. Their bread and butter necessities, always pressing hard on the English actor, obliged them to concentrate on their legitimate work. However, they were all devoted to hockey, especially Mr. Benson, and the Benson Hockey Club often played such a strenuous match with the local club where we were giving a performance that I have seen most of the actors stiff in the evening and playing their parts on the stage with difficulty.

Arriving in Bath on September 21, 1910, a couple of days before our first rehearsal, my trunk and I were soon on a cab jolting through the gray streets of this old and prettily situated city in search of the lodgings recommended by Mr. Forster, our manager. I found them in a dismal house in a very dingy street. The landlady, a stout, middle-aged woman with a very ruddy complexion, looked at me in surprise when I told her I was a member of Mr. Benson's Shakespeare Company. She showed me to my rooms which she said were to be eight bob. "A day?" I asked. "Wish I might get it!" she replied; "they are eight bob a week." Compared with American prices it was certainly very little, but it was the usual price for theatrical lodgings. Eight shillings a week included the rent of a sitting room and a bedroom, fire in the grate, cooking four meals a day of food I was to buy and send in, and serving them in my rooms at such times as I desired.

"Digs," the common name for lodgings, cut a large figure in a tour of this kind. Actors depend entirely on them, never going to hotels. The arrival of so large a company as Benson's in a city makes desirable digs hard to find unless they have been engaged long beforehand, as they usually are by old actors, who make the same tour each year and have their favorite lodgings. The digs I got into on this tour belonged to the lower middle stratum of society, but I found them comfortable, with some dismal exceptions, sometimes quite luxurious. Their privacy and adaptability to one's personal likings were so complete that I preferred the poorest of digs to the best hotel. Ten shillings a week was the average price. It was certainly the cheapest and pleasantest way of living away from home I have ever found.

One of our young actors and a student from Australia had rooms in this same house and, when the landlady told them a new member of their company had arrived, they came to my room and gave me a hearty greeting. Telling him I came from the United States to join the company elicited the remark, "Well, you are a good sport!" My maturity must have had something to do with his comment, for his companion had come a much greater distance for the same purpose. I noticed a shade of anxiety in his voice at first, but it vanished when he learned that I was only a student. "I was scared when I saw you," he said, "for I thought, here's a new star Benson has engaged to take my parts."

The room next to my bedroom, with a loosely fitting door between, had a permanent lodger—a disconsolate old man with a bristly beard and old-fashioned clothes, looking as though he had just stepped out of a Dickens story. Before I got up the next morning, I heard him shuffle about and make a fire in the grate; then bacon sizzled and dishes rattled. I wished cooking smells had the usual English respect for one's privacy.

The following day we had our first rehearsal. They had engaged for this purpose a large room in an old palace now used as a clubhouse for the men and boys of the Bath Cathedral. The play was "The Piper," by Josephine Preston Peabody, of Cambridge, Massachusetts, which had won the prize in the Stratford competition the previous summer and was to be included in Benson's repertory this year. I took no part in the rehearsal; it was for the actors' scenes, not for the crowd. I liked their clear, expressive voices—two or three of them as perfect as I had ever heard. Although they spoke their lines rapidly, their tones were so appropriate to the thought and their phrasing so correct it was a joy to listen to them. I was much older than the rest, but nobody appeared to notice it. I was evidently accepted simply as a typical American. When I said to one of the actors that this was the first rehearsal I had ever attended in my life, he replied, "You Americans are much more enterprising than we English are. I never knew an Englishman to change his business at your age and go in for the stage; but I suppose it is common enough in America."

After the rehearsal I went to my digs. There I found my dinner ready in my room, just what I had ordered that morning, nicely cooked and neatly served. It was so quiet and restful I invoked blessings on the man who first invented English lodgings.

At the evening rehearsal we worked again on "The Piper." The crowd of some twenty men and women was put through its scenes. My efforts were feeble and aimless. I was supposed to be a German burgher and I surely ought to have known how such a personality would act, but in this novel confusion my mind was a blank. There were thirty local children who did their parts joyously and naturally, and also two lovely little girls who were permanent members of our company. One of them told me she loved to act, and never wanted to do anything else. I wonder if she is still acting. She played her parts, even at rehearsals, as if it were glorious fun. She was at that time ten years old and had been on the stage four years. The other little girl, about the same age, confided to me that she would much rather act than be a typewriter, with fine scorn on the word. Their attitude toward the children hired for the week was haughty and superior. The latter looked up at these two with longing and envy. Their highest ambition was to travel with the company; it was the fairyland of their dreams.

Mr. Benson had charge of the rehearsal. I had a chance to talk with him personally a little. I found him a charming, quiet, bright-eyed gentleman. He reminded me of Henry Irving. He was thin and careworn, but so energetic and painstaking in all the details of the play that we were obliged to repeat some of the scenes many times before we did them well enough to suit him. I was very tired when the rehearsal broke up just before midnight, and realized how much hard work there may be in an actor's life. I slept like a log that night, oblivious to the tram cars that thundered past my windows.

Early the next day we gathered at the Theater Royal for our first rehearsal on the stage. I had never been behind the scenes in any theater and had some difficulty in finding the obscure stage entrance. Passing the sharp eye of the doorkeeper, I went through a low, narrow corridor, with a stone floor, to a barren, brick-walled cavern which I thought must be the stage, although it did not look at all natural. It was cut off from the auditorium by a very grimy curtain. Stacks of scenery were leaning against the walls. Furniture, properties and a wind machine cluttered the back of the stage. Dust everywhere and not a broom in sight! The doors of the two dressing rooms used by the stars of the company opened on the stage. The other rooms were on higher levels reached by narrow stone steps. Cards were on the doors of the rooms with the names of the actors who were to use them. I asked where my room was and was told the crowd had to dress in the corridors.

In this and in most of the theaters where we acted, the setting of the dressing rooms consisted of narrow plank benches with newspapers spread on them to keep the costumes as clean as possible, huddled with make-up boxes, tights, costumes, sticks of paint, crepe hair, bottles of spirit gum, towels stained with grease paint, mirrors tipped against the wall, hooks high above the benches with our street clothes on them, all making a picture of a world full of life and color that was strange and interesting.

And then there was always an old, gray, pathetic figure mingling in the scene, who like an echo or a spirit seemed to haunt these dressing rooms. It was an old woman who, in every theater where we played, had the monopoly of the actors' laundry and went shuffling about the passageways and dressing rooms collecting our towels, stiff and strangely colored with the grease paint, to wash, returning them the next day remarkably clean, and charging a penny each.

At my first rehearsal on the stage we did the trial scene in "A Winter's Tale." I was one of the crowd of peasants. Although it was only my second day at the work, my embarrassment had worn off surprisingly and I found I could enter into the spirit of the scenes quite well. I exclaimed against Leontes' jealousy and cruelty, expressing my indignation with such gesticulations as seemed fitting, and found a surprising exhilaration and refreshment in this unwonted exercise of my emotions. But it flashed across my mind occasionally how glad I was that Boston was three thousand miles away.

Besides the rehearsals the students were obliged to attend classes in elocution, calisthenics, gesture, stage action, falling and fencing and dancing. At one of these classes that afternoon, Mr. Benson talked to the students about the work of a crowd on the stage. We must not, he said, allow ourselves to think it unimportant, for the success of his plays depended largely upon the work of his student crowd. It was the best training an actor could have. It was far better for any young actor to begin in the crowd than in speaking parts. He admonished us never to get between the actors and the audience, for that would queer the actor's focus; to place ourselves in groups of two or three and keep about an arm's length from each other to make the crowd appear as large as possible; to listen to the actors, comprehend their lines and respond to them with the right gestures and facial expressions; to be individual in such responses and not merely to imitate the others. He said he never dictated to his crowd what their precise action should be, for that made them wooden. "Think out your own business," he said. He wanted no one in his crowd who did not think for himself, and selection of individuals for speaking parts would be governed largely by their ability to use their brains.

Some of his other points were, not to try to learn gesture but to make the thought of the moment so intense that the right gesture would come of itself; to make every movement, even the way we walked, express an idea. He spent the rest of the two hours illustrating his points by supposing different stage situations, calling in turn on members of the class to act in them as we thought right and correcting us when he did not approve our ideas.

Later in the tour Mr. Benson gave the students another fine lecture which I remember clearly. One of the girls had left the company because she had been assigned a part in a students' play that was repulsive to her. Taking this as his theme he said it was better for an actor to play parts unlike his own personality, for they require deeper study and harder work. He spoke of the stern necessity of growing slowly into principal parts. Years of earnest work in minor parts were an absolute requisite for success. He had himself made the mistake of playing leading parts from the beginning, which he could do, as he had had his own company, but he said he would be a better actor now had he been kept in small parts for a few years.

I took notes of what he said in all his excellent talks on the act of acting. This was well for the lectures, but later I carried my note-taking habit too far. I bought the books of all the plays and wrote in them the crowd's business and the cues for entrances and exits, carrying the right book, when I was on the stage, tucked away in my costume. I soon found this was not a good thing to do; it confirmed me in my life-long habit of depending on a book and not on my memory. Quite the hardest thing I had to do in this experience was to learn to summon my lines from my memory when in the stir and bustle of the scene.

CHAPTER XXXII

TWO or three days later, in the evening, came my first play before an audience! It was "A Winter's Tale." At 6:30, I climbed the three dark flights of worn stone steps to the dressing room, improvised from one of the corridors, which I shared with a dozen students. It was low and dark with narrow, greasy benches around the walls and a single grimy iron washstand holding a jug of cold water for the use of all of us. A rough wooden frame with hooks for our street clothes filled the center of the room. My comrades were standing or sitting at the benches in various stages of disarray, some talking volubly, others silent and absorbed in making up. A cracked mirror with extraordinary powers of distortion hung on the wall, but no one used it, for most of the men carried small mirrors or pieces of looking-glass which, leaning against their make-up boxes, enabled them to study the effect of their grease-paint manipulations.

As I stood at the door taking in the novel situation, a young man gave me an ancient tunic and a pair of tights, saying, "Put 'em on and button the tunic behind." I arrayed myself in a few minutes, then asked the same young man, who was the wardrobe keeper, if I was to wear a wig. Glancing at my hair, he jerked out, "No. Bare head; rough it up." I had not been told that each man was expected to make himself up and as no instructor in the art was provided, I felt somewhat lost, until a kind young man who had been with the company for a year offered to make me up. I gratefully accepted. During the dauby process, the wardrobe man admonished me, "You should make up before you put your rig on," eliciting from my benefactor the retort, "You couldn't get any more grease paint on this collar if you tried."

I was a peasant in this play and went on first in the trial scene in the third act, as a spectator in the courtroom. The crowd filled the left of the stage close to the wings when the curtain went up. We expressed our sympathy with the Queen, our resentment toward the King, and our horror at his blasphemy when he cried, "There's no truth at all in the oracle." Then we mutinied, and threatened the King until his soldiers forced us back into the wings, creating such a pressure there that the scene shifters had much ado to prevent the front wing from going over into the orchestra. The stage manager ordered us in a hoarse whisper to go upstage, and the strain was relieved.

After this, we had a gay time in the sheep-shearing party. The jollity of the actor who played

Autolycus infected the whole crowd; we all became very vivacious. I enjoyed it hugely and found it easy to forget the audience, which seemed to my myopic eyes merely a shadowy monster on the other side of the footlights, quite out of my world. This ended the work of the crowd for the evening. I changed back to my street clothes, learning incidentally that it is better for the skin to remove most of the grease paint by a dry rub on a towel, postponing soap and water until the next morning. It made my pillow by the end of the week gaudily reminiscent of each play I had been in.

When "The Piper" was playing, nearly the entire cast—actors, students and children—were always on the stage, talking and joking for fifteen minutes before the curtain went up.

The children were very picturesque in their gay dresses and were happy as larks, playing with the property toys so hilariously that the stage manager had much ado to hush them. "Clear the stage" sent us all to our places. As a member of the burgher crowd in the first act, I laughed at the antics of the animals from the ark, scorned the Piper when he demanded his pay for killing our rats, went piously into the church when we thought we had him squelched, but soon came rushing out when the alarm bell rang because he had piped our children away with the lovely tune that had set us dancing behind the scenes when we were supposed to be at our devotions. When the crowd was not on the stage I watched the charming play from the wings. It was delightful to see the children all acting as if they were playing a jolly game together.

In some cities the local children hired for "The Piper" were not all prepossessing and I found that our actors and students were bribing with candy the best looking and cleanest children to run to them in the final scene when the Piper brings our children back. This left the undesirable children with no one to welcome them home. To remedy this, I felt obliged to assume the place of father to a dozen or more of the young ones. But the audience were always so absorbed in the joy of that closing scene that they never seemed to notice the size of my family, nor that my children were all about the same age.

I wondered if our United States laws that keep children off the stage are altogether good. Every child in "The Piper" was better for the experience. I believe the stimulus to their imaginations and emotions in such a play is of more value to them than much they learn at school. Morally, their environment in such a company as Benson's couldn't have been better. They had a matron to look after them, but her only duty seemed to be to keep the exuberance of their spirits within reasonable bounds. It seems a pity that our laws should keep such a beautiful, uplifting play as "The Piper" from the American stage.

The crowd went on again in the second act in a procession escorting Barbara to the convent, all singing the "*Dies Irae.*" The Piper with his magic pipe turned our slow march into a waltz and bewitched us so completely that we danced away leaving Barbara to be rescued by the Piper. We went on again in the last act, when Michael and Barbara returned. We raged at them as the Piper's accomplices in stealing our children, and also at the Piper when he is arrested and brought in. We were abashed when he scolded us for being so selfish and amazed when Veronica is raised from the dead. We listened in awe when the music of the lost pipe came through the air and rejoiced when all our children came rushing from the wings headed by a little Irish terrier barking furiously. Finally, while we parents embraced our children, the play ended with the departure of the Piper at the call of "The Lonely Man" because "there is so much work to do," leaving us on our knees before the church.

The audience were always enthusiastic over "The Piper" and Mr. Benson usually received an ovation.

My first week on the stage had been crowded with new and interesting experiences. I had taken part in seven performances of five different plays—"The Piper," "The Taming of the Shrew," "A Winter's Tale," "Twelfth Night," and "The Merchant of

Venice," which gave me an opportunity for a great variety of acting, and gave me a better chance to study dramatic speech at close range than I had ever had before.

One morning a list of lodgings in Birmingham, where we were to play the following week, was posted at the stage entrance. This was done early to give us plenty of time to engage our rooms. The choice of digs was always a problem. Inquiring of some of the actors, and finding them reticent about the best places, as they naturally wanted the first choice themselves, I wrote at random to several addresses.

On Saturday trucks went around to our various digs collecting our trunks for transfer to the next city where we were to play, and early Sunday morning I went to the station and found a special train waiting for us, with all the company on the platform chatting jovially. Our names were on cards in the windows of the compartments, the women separate from the men. Our baggage and scenery went in four freight cars attached to the train.

The route was through an interesting region. I had Baedeker's guide and a geological atlas of the country with me. I offered to share them with some of the boys, but they were not interested. On the way one of our leading actors came and sat down beside me, and questioned me about the chances of his getting an engagement in America. He said an American engagement gave an English actor great prestige. He wanted to go to America very much, but feared to make the venture without being sure of an engagement. I realized how little I knew about the American stage; I was able to give him very little information.

CHAPTER XXXIII

THE next week we were in Birmingham, where the same plays were put on as in Bath, with the addition of "Macbeth" and "The Merry Wives of Windsor." Our rehearsals were held in a dilapidated old hall, lit by skylights, which we entered through a gin palace. On our tour it was customary to hire such halls for rehearsing as there were no others so easily available. It gave me an opportunity to study English beer shops, but I didn't find them at all alluring. The best possible argument for temperance would be a public exhibition of some of their habitués. The English bartenders were women, usually young and often very pretty. In the high-grade beer shops there was a separate compartment with its own entrance where workingmen go for their drinks. The same bar maids serve all grades of customers, but with a manner that is graded from the gracious smile that goes with the well-dressed man's drink to the scornful slam with which the laborer gets his beer. There is also a big difference in the price of the drinks in the various grades. The drinkers, both men and women, sit and chat at tables in little parlors adjoining the bar. There is always a hall in which the various societies of the town meet, their drinks paying the rent. Benson must have paid rental for the halls he used, for I never saw any of our men drinking.

The picture gallery in Birmingham had some pre-Raphaelite paintings and drawings which, with the superb Burne-Jones windows in the cathedral, I found attractive. I noticed our players went to picture galleries to get suggestions for costumes and for making up their faces for various characters. One of the young actors was devoted to the study of old armor and weapons and spent all his spare cash buying books on the subject. It could not have been a large sum, as the salary of the younger actors was only a pound or two a week. But they lived on that and some of them saved money. One of our students, who was evidently "risking his all" in joining the company, told me if he could get an engagement by which he was sure to get a pound a week it would make him contented for life! I soon learned that the actor's life in England was precarious, and particularly hard for women. We had many more women students than men and, as there were fewer speaking parts for women, I noticed a rather bitter competition for the few parts open to them.

CHAPTER XXXIV

I HAD a delightful little talk with Mr. Benson at Birmingham in the wings one night, as he was waiting to go on in "The Piper." I asked him if he was tired from the afternoon's hockey game, which I noticed had lamed some of the actors. "No," he answered, "I am one of those fortunate people who never tire. Playing King Lear twice in one day came nearer tiring me than anything I ever did." However, I felt sure he had too much to think of besides his parts in the plays. An actor can hardly do his best work with so many managerial cares on his mind as he had. Much that I did not like in his speech tones on the stage probably came from his habit of thinking about something else when he was speaking his lines.

Another day when we were changing towns, I had a talk with Mr. Benson on the station platform, waiting for the train that was to take the company from Halifax to Bradford, I think it was, and he invited me into his compartment to finish our talk. Our discussion covered Emerson, Whitman and Shakespeare. His ideas were largely based on Eastern philosophy and I found myself in accord with many of them. He believed that Shakespeare is one of the most powerful spiritual forces in the modern world, destined to unify all movements having for their object the uplifting of humanity, and to change all ugliness and discord into beauty, sympathy and love, harmonizing all mankind and bringing the golden age, when shall be quenched

the earth-consuming rage
Of blood and gold—till men should live
and move
Harmonious as the sacred stars above.

It is gratifying when others approve our opinions on their merits, irrespective of who we are or any other circumstance. Usually we, like the dramatic critic in "Fanny's First Play," want to know who wrote it in order to tell what we think about it. Mr. Benson knew nothing whatever about me except that I was an eccentric American who at the age of fifty-five took it into his head to come into his Company. For this reason I felt his interest in my opinions quite as a tribute to their worth uninfluenced by any adventitious regard for my identity or previous accomplishments.

One night when we played "The Merry Wives," as the crowd didn't go on till the last act, I went in front and saw the first three acts. I never enjoyed a play more, and was surprised to find that, instead of the illusion vanishing, as I thought it might after I had become familiar with the other side of the curtain, it was stronger than ever. I had not realized before what a fine lot of players there were in our company; one cannot really judge the acting while standing in the wings. I and the rest of the crowd went on in the final scenes around the Herne Oak in Windsor Park. Our work was intricate dancing; it went well for we had been well trained. I was certainly a boy again that night and Boston was very remote.

We played "Macbeth" here for the first time on the tour. We students were lords and officers, first in Malcolm's household and army, and then in Macbeth's, and my changes in the last act between the two armies were so rapid that at times I couldn't be sure for whom I was to shout. We had a very realistic fight. The local men who were hired as supers for a shilling a night had no fight in them. They stood about like posts, and furtively chewed tobacco when our drill sergeant was not watching them from the wings. This was lucky for me, for, had they fought with the energy and abandon of our students and actors, there would have been real corpses on the stage when the act was finished. I was the captain of Macbeth's army in this last fight and the battle raged around me. I and my army were finally driven back into the wings and when I came to myself I was sitting in the witches' cauldron, gladly noting that, thanks to my helmet, my eyes and scalp were intact, but wondering where I could get a cut on my thumb sewed up. I never expected to be butchered to make a Birmingham holiday.

While we were still in Birmingham I sent a tip to the doorkeeper of the theater where we were to play in Sheffield and asked him to select me a lodging there. He wrote me that all the best ones had been taken, but that he had secured for me one over a beer shop he thought I would like. When I arrived in Sheffield on the Sunday afternoon and saw the place I was dismayed; it was in a wretched old stone house close to the railroad tracks, and to reach my rooms I had to pass through the beer shop. But they were sunny—when the sun shone—and had a fine view of the city running up a high hill across the tracks. It was a very small beer shop. The landlady, whose husband was a cutler working in one of the great Sheffield shops, confided to me that, although she sold only £2 10*s.* worth a week now, she 'oped to do better when she got the new bar hin.

I went to St. Peter's Church in the evening. Returning to my rooms, I found the beer shop full of young fellows talking vociferously. They hushed as I came in, and eyed me curiously as I passed through. One of them remarked in a hoarse whisper as I went through the door, "'E ain't no actor; 'e's a preacher." They kept up a loud, quarrelsome, half-drunken arguing all the evening. Locomotives, too, were shrieking and puffing under my window and the prospect of sleep was dubious, but at 10:30 the row downstairs stopped suddenly. The landlady had evidently turned them all out. I went to bed and slept well in spite of the rumbling, hissing and puffing of the locomotives under my windows.

I commemorated these Sheffield digs in my diary:

"Last night I had a fight with a ferocious flea. He felt as big as a shrimp when he made his presence known just as I was going to sleep. I went on the warpath but couldn't catch him, so I got up and shook all my garments out in the dark entry. When I went back to bed I found I had eluded him. I went to sleep and dreamed that infuriated bug raged up and down the entry all night, seeking me. I have no qualms of conscience in getting rid of these reptiles where they may find other victims, for no one else seems to mind them. I wonder if much inoculation hasn't made others immune! This is the first serious fray of the kind I have had since I left Bath. I have a complex system of hills and ridges to show where my assailant carried on his operations."

That night I thought I must change to a hotel, but when morning came and I found I had slept soundly after all, I decided not to do so, for I could live in hotels any time, and as there were to be only a few weeks of this experience for me, I must not lose any phase of it. Indeed fleas have their place in the traditions of the English stage, for Christopher Marlowe paid his tribute to their gallantry in Dr. Faustus, saying, "They are as bold with my flesh as if they had paid for their meat and drink."

They put on "Masks and Faces" here one night, and as I had no part in it I went in front and saw the play. It was beautifully done. If I had ever had any conceit in me, watching the players that night would have cured me. I felt that by working hard for four or five years I might learn to be an actor, but I was sure no shorter time would suffice.

We had much gloomy weather in Sheffield and I should have hated the place if I had not been so delightfully busy. As it was, I did not mind rain, fogs, clouds, dirt or any of the many other uncomfortable things. The hard work and late hours agreed with me and I was never more perfectly well or happier in my life. More and more I liked living in digs; it was more private than a hotel and I could have just the kind of food I liked, which was almost entirely vegetarian. My landlady remarked one day, when she was setting my table, that she never knew any one could live without meat or fish. She said she often had to whip her twelve-year-old son to make him eat some meat or fish, for she thought he could not grow unless he did. As I seemed to thrive without those articles of food she decided to give her son the food he preferred and later told me he was very happy at the change in her ideas regarding his diet.

CHAPTER XXXV

WE spent the last half of October in Liverpool. The fascination of the life was still growing on me and I began to think it would be hard for me to leave it. One night when "The Piper" was on, availing myself of our leader's injunction to think for ourselves in our work in the crowd, I tried an original bit of business. In the second act, instead of succumbing at once to the witchery of the Piper's tune, which, when we burghers are marching in singing "*Dies Irae*," makes us dance madly off the stage, I pretended to resist the Piper's spell, and expressed my disapproval of the actions of the other bewitched burghers by shaking one of them, as if trying to bring him to. It worked well, but not having told the man I assaulted what I was going to do to him he was so startled that he tumbled over a "mossy bank" just before he reached the wings. It was in harmony with the scene, although his concussion with the "bank" sounded rather hollow; but he was quite put out with me. "For heaven's sake," he said, "don't spring such a thing on me again without rehearsing it." The stage manager grinned, and didn't say anything. The scene "got a laugh," but the boys wouldn't believe that I did it on my own responsibility.

When "Julius Cæsar" was played in Liverpool, I was one of the four officers who bore off the dead body of Cassius from the field of battle in the last act. I had one leg; that was easy and I did my part all right. But one of the other students who was struggling with a shoulder stumbled and dropped his corner of the corpse. The dead man hissed a profane rebuke at us as we picked him up again and bore him into the wings. Then he became very much alive, expressing in violent words his opinion of us and particularly of the student who had bungled his shoulder.

I had my first speaking part that night! I was posted with others in the wings ready to lead my Brutus soldiers across the stage the instant the curtain went up. The moment we started we were to shout "Ave Brute" and to keep it up while we were on the stage. I let my shout go promptly with all my might, expecting to have it drowned out as usual by the other soldiers; but, in the excitement of the moment, my soldiers forgot to shout and I had that one short line to myself. It was my début, but I must say that in my ears it sounded appallingly lonesome. The others came in all right on the next shout.

In the rehearsal one day of "Julius Cæsar," Alfred Brydone, who played Brutus, gave his speeches with their full expression. This was unusual at rehearsals. It gave me a fine chance to study his voice, which was as near perfect as any I had ever heard. He had attained his perfect utterance intuitively, but I am sure, none the less, that where one person attains excellent speech empirically, a thousand could do so if they were scientifically taught.

Our actors were prejudiced against the study of elocution which, they said, was sure to make one's voice stilted and mechanical. They instanced the pupils of elocution schools, most of whom have to work for months when they get on the stage before they can overcome their bad vocal habits. This is undoubtedly so, but it is not an argument against the right study of speech.

I have stood for hours in the wings trying to analyze Mr. Benson's speech, for it had many unpleasing tones in it. I finally decided that the chief defects in his articulation were monotonous melodies and cadences and allowing most of his syllables to begin and end on the same note instead of invariably gliding up or down and ending on another note as they should. The latter defect is the reason why he had to drawl or shout his emphatic words. No one can adequately express the innumerable shades of emotion without the command of a vast range of melodies and cadences and a perfect control of the slides of his voice throughout its entire gamut. Mr.

Benson had everything else to make him the leading actor-manager on the English stage of his time, yet I believe his defective speech-tones have kept from him the fame and fortune he deserves. I have observed so many other instances of the power of a man's voice to make or mar his fortunes that I am sure one of the important elements in any one's success in life, whatever his vocation, is the study and practice of the marvelous art of human speech.

In one mill town which our company seldom visited, I could not find lodgings and had to go to a hotel. Before the end of the week I had a bad attack of indigestion which disgusted me more than ever with hotel life. Not only was the food vastly less to my liking than it was in lodgings, but I felt nervously exhausted from the confusion and lack of privacy. I had to sit and study in the public room, the only one in the house that was heated. The other guests were commercial men of all ages. They were very sociable, but their talk was not edifying, and I felt bewildered in getting into a world so different from that in which I was living. The landlord told his guests I was an actor. They asked many questions in a tone that indicated they pitied me for having to do such degrading work. I was indignant to find by their innuendos they thought acting an immoral business, but I did not attempt to change their opinions as they seemed to be the kind that always have their minds made up permanently. A little dieting cured my sickness in a day or two, and I was glad to get back into digs again in the next city.

One old fellow I shall not forget, although I had forgotten what noises men can make when they eat, and how little they have to talk about. He was a nice-looking old graybeard eating his belated supper in the hotel dining-room. He ate his soup audibly, grunted, breathed hard, coughed, blew his nose, cleared his throat, smacked his lips, put his knife in his mouth, rattled it on his plate, set his cup back into his saucer with a bang, and did other disagreeable things. The old gentleman took a nap on the lounge after supper. When I left for the theater he was snoring.

With the single exception of these two days' sickness, the cause of which was obvious, I felt all through the tour the delights of a more abounding mental and physical good health than I ever had before. The reason for this could not have been altogether the novel and interesting work and the dancing, fencing and other exercises I was taking. I had done interesting work all my life and had always kept myself in condition by exercising. But never before had I felt such a constant freshness, exhilaration and capacity for work and study as I had had during this theatrical tour. I have a theory. We imperturbable Anglo-Saxons, by repressing our emotions, atrophy by disuse that part of our brains which is exercised only when we let ourselves go emotionally—something we seldom do. It seemed to me the delightful feeling of exhilaration lasting for hours after an evening on the stage in an exciting play came from the exercise of this seldom used part of the brain. I had never before expressed such a variety of emotions, and after the early embarrassment had worn off, they were genuine and absorbing. I was living under physical conditions that could hardly have been worse. The weather was foggy, misty, snowy, rainy, sleety, with a rawness indoors and out that entered the very marrow; my lodgings were often unpleasant and noisy; the dressing rooms at the theaters usually unfit for kennels; the stages, draughty, dusty, and cold. Yet nothing annoyed me and I was happy and contented all the time, although at any other period of my life such conditions would have been unbearable. Is it not to feed their starved emotional natures that people attend all the funerals in town and take the last tearful view of the remains? In my stage work I was doing the same, but much more thoroughly and agreeably. Whether my theory is correct or not, it is certain that what I was doing was good for both soul and body.

CHAPTER XXXVI

WE were in Manchester two weeks early in December. Here I had my first experience with a black English fog lasting several days and filling the theater itself, so that even when the lights were on, peeping through the curtain, we could not see the balconies. Groping through the streets in the darkness gave me some new thrills which were enjoyable until the novelty wore off. Our audiences were small for all the plays except "The Piper," which drew crowds because, I believe, it made the fog glow like a golden sunset.

One night there was great excitement in the company. It was announced that we were to play "The Piper" at the St. James Theater in London. That charming American play had been so well received in the Provinces that London wanted it. A few nights before, Sir George Alexander, the owner of the St. James Theater, was in our audience. Our players did their best work and Sir George engaged Benson and his company for a season of five weeks.

The tour closed there in Manchester, on December 10, 1910. It had lasted only twelve weeks, but its beginning at Bath on September 21 seemed as remote as if years had passed. We were not to have much rest; rehearsals for the London season were to begin on December 15.

The first "Piper" performance in London was on December 21 to a large and enthusiastic audience. It was an important event to those of our actors who had never played in London before and they played their parts so carefully they did not seem natural to me, but the newspaper criticisms were nearly all favorable. That in the *Westminster Gazette* I considered the most pleasing, for it said the crowd in "The Piper" was the best that had been seen in London for a long time.

The last performance of "The Piper" in London was on January 28, 1911. It had been a great success. When the curtain fell the children crowded about Mr. Benson hugging and kissing him, with tears channeling down their powdered cheeks. Like "The Piper" children in every city, they asked him for permanent places in the company, and he was so kind-hearted he could not deny them outright. He wrote their names and addresses in his notebook and the little ones went away very happy.

During these weeks in London my time away from the theater was filled with dancing and fencing lessons, with visits to picture galleries and museums, geological excursions to points near London, concerts, theaters, and churches of all denominations and religions.

Just before his next tour was to begin I told Mr. Benson that it was doubtful if I would go on with him, as I did not want to displace some young actor who had to make his living. But when he spoke of intending to promote me from a student to regular membership in his company and to give me good parts in all his plays, and finally said his next tour would include a month at the Memorial Theater at Stratford in celebration of Shakespeare's birthday, my misgivings vanished and I decided to continue the experience with him.

On January 28, 1911, the company started on its northern tour. I went with it as an actor with my name on the programs! The tour took in Aberdeen, Dundee, Edinboro, Glasgow, Middleboro, Hull, Newcastle, and Hanley, and reached Stratford April 9. The parts assigned to me were: Peter the Sacristan in "The Piper," the Clerk in "The Merchant of Venice," the Priest in "Hamlet," Hubert in "King John," Principal Watchman in "Much Ado," Master of the Horse and Father Thames in "The Critic," Bishop of Ely in "Henry V," Bardolph in "The Merry Wives of Windsor." They were small parts, but with lines to speak which gave me the desired opportunity to practice my speech studies.

Early in the tour I had to work hard to conquer a tendency to forget my lines when on the stage. It troubled me badly the first time I played the priest in "Hamlet." They warned me that the priest was a hoodoo part and that the first time any one played it he was sure to dry up. There were thirteen lines in the part, which may be the reason for this superstition, but I knew them so well that I could say them backwards. I never dried up at the rehearsals and was sure I should not have any trouble at the performance. But, alas, they were right. As I stood solemnly at the head of the grave with my book and beads, the two men waiting under the stage to grab Ophelia's dummy when it is lowered into the grave and yank it into a side opening to give room for Laertes when he jumps in, distracted me with their levity, which contrasted so sharply with the scene on the stage. When I came to the line, "Shards, flints, and pebbles should be thrown on her," my mind blacked out. Laertes prompted me and I managed to stumble through to the end of my speech. It was especially humiliating for me, brought up in a crockery store and a student of geology, to be floored by shards, flints and pebbles! However, I need not have felt so badly about it. A few days later I heard one of our best actors, playing Dogberry in "Much Ado," skip several pages of his lines, which carried him into the next act. It was incidentally most interesting to hear the other players improvise until they got him back to his right place, when all went well again.

Soon after we reached Scotland some of the younger Benson actors, knowing they would be out of a job when this tour ended, organized a little company to play during the summer at the resorts and small towns in the south of England. Frank Growcott, who was a scene painter as well as quite a fair actor and had managed such enterprises before, was the leading spirit in it. His plan was to put on some of last year's successful London plays. He offered me two pounds a week salary and some of the leading parts if I would join him. It would give me in one summer a different and broader experience than I could get if I stayed with Benson, so I was tempted to accept, but I deferred my decision. Later, Growcott, finding he could not get from London all the plays he wanted, asked me to write some for him to add to the repertory. As the Dickens centenary was near, he suggested that I dramatize three of Dickens' novels.

I had never written a play. Here was an opportunity! I had plenty of time in the intervals of my other work, so I started into this new business. I chose *The Tale of Two Cities* to begin with and went about it systematically. When I had an act finished, I called together the players of the Growcott Company to discuss and rehearse it. This suggested improvements which I incorporated for the next rehearsal, repeating this process until the play was satisfactory to all of us. I soon became quite expert and found absorbing interest in digging actable scenes out of Dickens' stories. Finishing

"The Tale" in about a month, I took up *Oliver Twist*, made a pretty good play out of that book and had it well rehearsed by the time we reached Stratford. Then I started on *Nicholas Nickleby*, which was much harder to get into shape. All this had to be done, of course, without interfering with the daily Benson plays.

In the rehearsals I played the part of Mr. Lorry in "The Tale," Mr. Brownlow in "Oliver Twist," and Sir Mulberry Hawk in "Nicholas Nickleby," having, as the author of the plays, the delightful privilege of changing my lines and giving myself a few more speeches, if I wanted to practice some difficult vocal cadence or intonation.

Acting leading parts in my own plays was so pleasant and interesting that I decided to accept Growcott's invitation and join his company. Another reason for doing this was that, having promised my wife to take her to Egypt the following October, I knew my English stage experience must soon end, and I wanted to get as much of it as possible that summer.

My last month with the Benson company was spent at Stratford. It was a fine climax to the tour. During the celebration of Shakespeare's birthday, lasting from April 7 to May 6, 1911, I played a part every afternoon and evening in a wonderful list of plays—"The Piper," "Much Ado About Nothing," "The Critic," "Julius Cæsar," "Macbeth," "Midsummer Night's Dream," "Twelfth Night," "Henry V," "The Merchant of Venice," "The Merry Wives of Windsor," "Othello," "Richard III," "As You Like It," "The Taming of the Shrew," and "Romeo and Juliet."

Many prominent London players came to Stratford on different days to take the leading parts in these plays. Among them were Oscar Asche, Lillie Brayton, Matheson Lang, Hutin Brittin, Fred Terry, Julia Neilson, Henry Ainley, Lena Ashwell, Cyril Keightley, Violet Vanbrugh, Constance Collier, Lewis Waller, Madge Titheradge and Marion Terry. It was a delight to play my small parts with such actors and it gave me the finest possible opportunity to study their skilled voices in a great range of emotion.

It was a tremendous test of Benson's organization. I don't believe there are many groups of actors in the world that could have presented such a list of plays so smoothly as these players did. It was made more difficult by the fact that nearly every play had to be changed in its lines and business, sometimes at a day's notice, to suit it to the ideas of the London star who played the leading part in it.

It was a crowded month, but nevertheless I found time to work on "Nicholas Nickleby" and nearly finished it before I bade good-by to the Benson players on May 7, when they left Stratford for the remainder of their spring tour. Mr. Benson's last word to me as I thanked him for his many kindnesses was, "Don't lose your eternal youth, Mr. Watson."

I was sorry to leave him and his notable group of men and women of his company. The months I had spent with them seemed like a crowded lifetime to look back on. No work I had ever done was more to my taste and if I had been younger I should probably have continued in it as a profession.

CHAPTER XXXVII

MY life lost none of its intensity or interest during the next month, which I spent in London, polishing up my Dickens plays, helping Growcott get his scenery and costumes ready, and rehearsing our players every day. On June 17, 1911, we opened the Dickens tour by playing "The Tale of Two Cities" at Waltham Cross, near London. It was a funny show. Everybody was hoodooed. There were too many scenes in my plays, which made the waits too long. Our scenery didn't fit the stage. The guillotine collapsed just as Carton was going to have his head cut off. There was a mix-up in the costumes so I had to play the mild Mr. Lorry in Bill Sykes' clothes. Most of us dried up in our lines. One of our girls went into hysterics. One of our men got so rattled that he put in some of his "Oliver Twist" speeches, mixing us up badly. We dropped the curtain and made a fresh start. The only good thing about the performance was the patience of the audience. They didn't even laugh at us. A bombardment with ancient eggs would have been justified.

During the play I felt that I was certainly putting the capstone or the tombstone on my theatrical experiences. I was solemn when I went to bed that night, but the next morning it struck me as funny. Growcott and the rest of the company had long faces when I met them, but my hilarity over the mishaps of the evening cheered them up and we pitched into the rehearsing more vigorously than ever, getting ready for our week at Canterbury, where we were to play next.

We played our entire repertory at Canterbury. There was more or less friction in the performances, inevitable with such a green company, but nothing like the awful mess we had at Waltham Cross. By the end of the week we were playing like old stagers. Every time my plays were put on I was on hand with my notebook, watching for places that needed to be changed or padded. The next day I usually spent in rewriting some of the scenes. This, in fact, was my favorite occupation and the apprehension of our actors, for I never got the plays to suit me.

Our week at Canterbury didn't quite pay expenses. At Deal we did better. Then we had a succession of one-night stands at a dozen small towns, with varying fortunes. Soon after the first of July the weather turned very hot, and as our audiences began to diminish, each week we had a deficit. Growcott realized he had started his tour too early in the summer, for it is impossible to get good houses in hot weather. He was looking thin and worried. At last he came to me with his troubles. Unless he could find money to pay his debts and tide over the next few weeks, the company would have to be disbanded. As I happened to have a little money on hand I decided to help him. I was tempted not to, however, for I knew that if I didn't advance the money, the players, being penniless, would have to walk back to London, sleeping under the hedges and haystacks (as Growcott had to do once when a company he was with failed up), and I could go with them, which would be a unique experience. What interesting bits of life we can dodge if we have a little money! Our audiences, large or small, were enthusiastic at least, and we had many good notices in the local papers.

I had written my daughter, who was at Radcliffe College, to come over and share this experience with me. She joined us early in July, while we were playing on the Isle of Wight. We gave her good parts and she enjoyed the life as much as I did. She was also our orchestra. She was an excellent pianist, and she insisted on playing classical music in spite of Growcott's misgivings, but it was received so well that our audiences were attentive between the acts as well as when the curtain was up. She often had flowers presented to her for her playing, but occasionally women would express their pity for her lot in life. At Lynton, a dear old lady told her she was much too fine a pianist to be with a company of strolling players and offered to help her get more "respectable" work. My daughter thanked her, and told her she felt obliged to stay with the company until the end of the tour, when she would have different work.

The Dickens Company had many ups and downs during the summer. We played in twenty-six towns, sometimes making money, as often losing it. We were badly handicapped by the fact that the summer of 1911 was the hottest and driest that England had ever known. If we had had the usual English weather, Growcott would probably have made a profit. However, he and a dozen first-rate young players had pleasant work with good salaries during a period which is always the actors' dull season.

It was rather a sad occasion when I left them at the end of August, but my time was up, my daughter had to return to America for her college work, and my wife was reminding me of the promised trip to Egypt. The players gave us a farewell party one evening on the stage after the curtain fell, with speeches and a few tears. Then we went to London by train—not on foot.

Before I left, I gave Growcott all my plays, and the scenery and costumes for them, and cancelled his notes for the money I had advanced, so he could continue the tour free from debt. But all it cost me to enable him to keep his company going that summer was small compared to the benefit I received. I had had a summer full of charm and interest as well as of wholesome hard work. I had learned to know some fine young men and women, whose courage, kindness, patience and endurance under strain had impressed me profoundly. I had acquired a practical knowledge of the theater in all its departments and had gained some facility in writing plays, besides having had an opportunity to act good parts. When I was with Benson, I had felt I was keeping some one out of a job; but with Growcott I had the pleasure of knowing I was insuring jobs for a dozen good players.

This ended my English stage life. It is hard to believe that so much was crowded into a year and a week. I came through it with much better health, and a more sympathetic mind, and with a vastly better ability to read than I had ever had before. My voice also had improved and I was better able to put myself into the spirit of what I was reading.

Growcott continued the tour three months longer; then, his best players having left him for other jobs, he disbanded his company. Later, he was a movie actor.

CHAPTER XXXVIII

OUR journey to Egypt was made via Münich, Salzburg, Vienna, the Austrian Alps, and the superb caves of Adelberg, to Trieste, where we took the steamer for Alexandria. My first impression of Egypt was not pleasant. The pandemonium of howling, gesticulating natives on the wharf when the steamer tied up was disgusting. I couldn't understand why these men were allowed access to the landing place. But I remember it wasn't many years ago since the New York cab men used to mob the passengers landing from a Fall River steamboat in quite the same way.

A few weeks later we met, up the Nile, a middle-aged Englishman and his young wife, who had come from England in a tramp steamer on their honeymoon. It was the first time either of them had been out of England. He told me they stayed on the dirty old freighter a week after it arrived in Alexandria harbor before they got up courage to fight their way through the howling mob that greeted them every time they came on deck.

We spent three months in Egypt, going on the Nile as far as the second cataract, visiting pyramids, tombs, temples, museums, studying Egyptian history, religion and art.

I shall not describe and comment on all we saw and learned in Egypt. It would merely repeat what has been often told before. As in other places, the geology claimed a share of my attention, especially near Thebes, where I gathered Cretaceous fossils on the hills above the Valley of the Kings. This region brought out vividly the contrast between the length of man's history on earth and that of the rocks. The oldest of the tombs here were built about five thousand years ago, but the fossils from the rocks in which the tombs were excavated were of animals that lived many millions of years before the first man came on earth. Those animals left us only their shells and bones to wonder at, but during the comparatively few years man has been on earth he has produced these marvelous works of art and engineering which stand out so impressively against the background of the barren ages that preceded him. I found nothing in Egypt more interesting than the study of its archeology with its geology.

In my hotel, among the columns of the great temple at Luxor and in the Valley of the Kings, I gave several talks on the geology of the region illustrated by the rocks and fossils I had gathered. One of my geological discussions got me into trouble. I had been interested in comparing the desert sands with the beach sand I had often studied under the microscope at home. The grains of beach sand are usually angular for, although they may have been churned against each other by the waves for many years since they were set free from the parent ledges; yet, as each grain is protected by a thin film of water that acts as a cushion, its corners are not worn off. But, as the wind-blown sand has no film of water on its grains to protect them from erosion, their clashing when they are rolled by the wind knocks off their corners and they soon become spherical or egg-shaped.

This fact was probably well known to geologists, but I discovered it for myself in Egypt at this time. I carried my discovery a step further by examining the grains of sand in the sandstones of the region to see if I could determine whether they had been wind-blown in a desert or wave-washed on a beach before they were consolidated into the hard rock. To my delight, I found the grains in some of the sandstones were angular and in others, smoothly rounded. And I noticed that the latter kind of stones were often intricately crossbedded, which is also a characteristic of wind-blown sand. It was evident that some of the sandstones were of beach origin and that others had been formed under desert conditions.

With the enthusiasm of a discoverer, I was explaining this to a group of men and women who had gone with me to study the geology of the region about Thebes. An old Scotchman, who had joined our party, suddenly broke in with a dissertation on the wickedness of a man pretending to know more than the Bible. "When God created sand," he said, "He created it just as he wanted it. If he wanted it coarse or fine, round or sharp, He made it so, for He knew man would need all kinds of sand." As he went on talking he became more and more enraged over my "impious" ideas. Had I tried to answer him, his vehemence and volubility would have prevented me from uttering a word. I didn't attempt to argue with him. I and the other students of Egyptian rocks went on to the next point of interest, leaving the man declaiming to a crowd of natives who did not understand a word. A native policeman, attracted by the man's loud talk, came up to see if a riot was under way. He spoke to the eloquent Scotsman, but failing to quiet him, dispersed the crowd, leaving my dogmatic friend without an audience. I never saw him again.

It was the usual clash between the creationist and evolutionist, but about sand instead of man and the monkey. I wonder what he would have said had he known my beliefs about reincarnation and evolution! But he couldn't have been any madder than my sand notions made him.

The native people interested me greatly, especially the important part prayer seemed to play in their lives. Wherever we went in city or country at certain hours of the day, the Moslems could be seen praying with their heads bowed low toward Mecca. It was impressive but, accustomed as we are to more private praying, I sometimes wondered if their prayers were not largely for show.

An incident that occurred at Assuan showed me that prayer means a good deal more to them than I thought. My wife and I crossed the river late one afternoon to visit some ancient tombs on a high hill on the western bank. We were met there by the usual crowd of would-be guides that everywhere in Egypt spoil so many of the tourists' trips into interesting places. These men and boys followed us up the hill, officiously trying to help us climb, all talking at once. It was particularly annoying, for the region was entrancing; new views were opening out every moment and we wanted to linger and enjoy them. We ignored the mob as much as possible and finally reached the summit, where suddenly a superb vista was revealed of the river, the cataract, the desert and the distant mountains, all glorified by the setting sun. We felt as if we were in The Presence. I turned to the chattering crowd and said quietly and sincerely, "Go away; I want to pray!" The effect was surprising. Their leader, who understood English, spoke a few words in their language to the others. They hushed instantly, turned down the hill and left us alone. Nor did they trouble us when, two hours later, we went down to the boat.

In other places, to get rid of these men, I sometimes tried declaiming vehemently a few of Shakespeare's lines at them. One of my favorite quotations was, "Avant and quit my sight! Thy bones are marrowless, thy blood is cold," etc. With it I could often stop their talking and pushing and sometimes could drive them away. At first I thought it was due to some occult power of the words, but further experimenting proved it was the tone of my voice that was effective. If, with the same guttural voice, I declaimed such sweet words as "If music be the food of love, play on, give me excess of it," it had the same effect as the Macbeth lines.

I sometimes experimented on the natives with my pocket microscope. When one of them offered to sell me antiquities (made in Germany) I would take out my glass and look through it at their objects very solemnly. Then I would hand the thing back with a sternly accusing look. Almost always, the man would glance over his shoulder hastily at the nearest policeman, wrap up his goods and disappear. Sometimes in the markets, I looked through my lens at the small, beautifully marked seeds exposed for sale, and would let the natives standing about look too. Immensely interested they gathered in crowds about me to see, one after the other, the familiar seeds so miraculously increased in size and beauty. One day, when I was doing this in the market at Assuan, one of the men held out his hand to me with a number of the smallest Egyptian coins in it and eagerly beseeched me to "Make big, make big!" He was delighted to see his coins magnified six diameters, but was obviously disappointed when I took the glass away and he found that the apparent increase in his wealth was not permanent.

CHAPTER XXXIX

WE left Egypt the last of February and traveling via Sicily, Italy and France, reached England the last of May, and home on June 5, 1912, after an absence of nearly two years.

After such a stirring life it is not surprising that I found Braintree dull, and longed for the interest and excitement of Europe. But the autumn brought me congenial occupation and then the place didn't seem so uninteresting. My English stage work had increased my love for the oral rendering of great literature. More than ever it seemed to me an important part of a full life and I was glad to accept the many requests that came to me for public readings from the Bible, Greek Drama, Shakespeare, Robert Browning, Walt Whitman and the best of recent poems and plays.

Many of my readings have been given at schools, and judging from the letters I have received from both students and teachers, they have been of some educational value. All this work has given me pleasure and I think I have done some good by it, and perhaps partly paid the world for my keep since I left shipbuilding. Much of it has been done gratis, for the world has given me so much I need to take every opportunity to pay it back.

I have kept up my English stage practice by much amateur work, notably in producing the plays of Robert Browning. For the Boston Browning Society, of which I was president for two years, I have played the leading parts in "Luria," "The Soul's Tragedy," "King Victor and King Charles," "Pippa Passes," "Strafford," "The Inn Album," "Paracelsus," most of which had never been played in this country and two of them nowhere else, either, for I dramatized them myself.

Besides my reading and playing, I have also done a good deal of lecturing, especially about the telephone, for soon after I returned from Europe in 1912, I began to realize for the first time that the public was interested in what I had done in connection with that invention. The first intimation I had that the public would care for the story was a letter from a magazine in 1892 asking me to write a brief description of the scene when I first heard the telephone repeat an articulate word, as one of a series of articles, describing important moments in our history as seen by eye-witnesses, in order to preserve, while the participants are still alive, some pictures of leading events, the details of which would otherwise be lost.

I wrote the article and was just about to mail it, when it occurred to me it might be well to submit it to one of the counsel of the American Bell Telephone Company, George L. Roberts. He forthwith protested against my publishing it at that time. One of the endless series of telephone lawsuits was on, and I was a witness. He said that it would prejudice our cause before the court, for a judge would look with disfavor upon a witness who published the substance of his testimony before the hearing of the case and its decision on its merits. He was clearly right. So I asked the magazine to release me from my agreement.

Subsequently, through a number of years, I published parts of the story of my telephone experiences in shorter or longer form. Finally, somewhat elaborated, I delivered it as an address before the Telephone Pioneers of America in Chicago in October, 1913. Since then the American Telephone and Telegraph Company has printed it in pamphlet form under the title of "The Birth and Babyhood of the Telephone," and has distributed many thousands of copies of it. But all this printed circulation of it has not stopped the demand for the oral delivery of the lecture. I have told the story many hundreds of times and am doing so to-day, a dozen or twenty times a year. Whenever I am asked to deliver it I have a feeling of dismay at the thought of telling that old story again, but always after I get started, the spirit of those intense days enters me and then it is as if I were telling it for the first time. The story's appeal seems to be universal. My audiences have comprised every age and intellectual capacity from grammar school children to college faculties. They are all equally enthusiastic.

I have received many expressions of appreciation of my story, both orally and by letter, but the most gratifying words regarding it came from Mr. and Mrs. Bell soon after the story was first printed. Dr. Bell sent me a long distance telephone message from Washington, on May 26, 1914, in characteristic form:

"Hoy, hoy, Watson, are you there? That was a fine address you made at the Telephone Pioneers' Association at Chicago, which has just come to hand. Congratulations."

CHAPTER XL

THE years 1914 and 1915 brought the telephone back into my life still more. At my first lecture in 1912 to the Telephone Pioneers, Theodore N. Vail, President of the American Telephone and Telegraph Company, told me that, as soon as the engineers of the company had the first transcontinental telephone line completed, he wanted Dr. Bell and me to inaugurate its opening. I heard nothing further about it until the latter part of 1914, when John J. Carty, the chief engineer of the company, wrote me the line was completed, that the date of its inauguration had been fixed for January 25, 1915, and that he would like to have me confer with him on the details of the ceremony.

At the opening of the Transcontinental Telephone Line the San Francisco end of the line was assigned to me and on January 25, 1915, Dr. Bell in New York and I in San Francisco, in the presence of large audiences—the members of which were each supplied with receiving telephones so that they could hear all that went on—played our part in the ceremonies of the opening of the telephone communication across our great country. The line worked perfectly. I carried on the conversation with Dr. Bell, over this wire four thousand miles long, as easily as I had talked with him thirty-nine years before over the wire between Boston and Cambridge.

President Wilson talked from the White House in Washington to the Governor of California. President Vail, of the American Telephone and Telegraph Company, talked with us from Jekyl Island, Georgia, eight hundred miles farther away. Many other conversations were carried on and that same night the line was put into regular commercial use.

All through the ceremonies of the afternoon, the uppermost thought in my mind was the splendid work of the army of telephone research workers who had taken up the task where Bell and I had laid it down and, conquering a multitude of obstacles that were insuperable to us of the early days, had extended the scope of long-line telephony until it had reached the limits of our country.

The climax of the afternoon for me came when Dr. Bell asked me to wait a moment until he could connect another transmitter through which he wanted to talk with me. I waited, and in a few moments his voice came over the wire as loudly and distinctly as before, saying: "I am now talking through a duplicate of the first telephone you made for me and that we tested together in June, 1875. Do you hear me?" I answered that I heard him perfectly. Then, when he repeated to me the famous first sentence, "Mr. Watson, come here, I want you," and I answered, "I should be very glad to, Dr. Bell, but we are now so far apart it would take me a week to come instead of a minute," it seemed to me as if forty years of telephone achievement had been condensed into a thrilling moment.

That I had this notable incident in my life and that it was so successful was due largely to the organizing ability of that fine spirit—General John J. Carty, now vice-president of the American Telephone and Telegraph Company, in charge of research and technical affairs. And there are many other pleasant things in these later years of mine for which I am also indebted to General Carty.

Before I left San Francisco, telegrams poured in from the telephone managers in many parts of the West asking me to stop on my way home and tell to their people my story of the birth of the telephone. I accepted so many of these invitations that it was nearly two months before I got back to Boston.

In Los Angeles where I spoke to an audience of about 1,200, a sensitive transmitter was concealed in a large papier mâché bell suspended above my head, from which wires ran to many other cities and towns in California, so that my speech was heard by forty or fifty other audiences at the same time. In San Diego, a few days later, I learned something that indicated I might have had many more audiences than that. The San Diego manager told me they had heard every word of my talk, even the applause, and occasionally a faint voice that broke in with "That's fine! Good for you, Watson." I told him I couldn't understand how this could be, for no one uttered a word at that lecture except myself. He investigated, and found that some of his linemen had climbed the poles in the suburbs and connected their testing sets into the wire over which my speech was being transmitted. The mysterious words the manager heard were the remarks which the linemen had made, unconsciously expressing their appreciation of my story with their lips too near their testing transmitters. I may have had that night many such audiences of which there is no record.

Honors have come to me in recent years. In May, 1919, I was made Fellow of the American Institute of Electrical Engineers. A few days later, I spoke at the meeting of the Institute when the Edison medal was presented to Dr. Bell. On March 17, 1917, I was one of the speakers at Carnegie Hall, New York, when a national testimonial in the form of a gold medal was given to Dr. Bell by the Civic Forum.

In 1919, Union College of Schenectady, New York, conferred on me the degree of Master of Arts. President Richmond's words on that occasion were:

Photograph by George H. Davis, Jr.

Thomas A. Watson

> Thomas Augustus Watson—man of large and varied interests, founder and sometime president of an important shipbuilding industry, inventor and investigator in several fields of science. He assisted Alexander Bell in the experiments which resulted in one of the greatest of modern inventions. Dr. Bell's was the first human voice to speak by telephone, Mr. Watson's was the first human ear to hear. Informed in the arts as well as in the sciences, lover and student of Shakespeare, a man of culture. For your attainments as well as for your achievements, *honoris causa*, I admit you to the degree of Master of Arts, and direct that your name be entered on the roll of the Honorary Alumni of Union College.

On June 21, 1921, Stevens Institute of Technology gave me the degree of Doctor of Engineering, President Humphries saying:

> Thomas Augustus Watson—telephone pioneer, associate of Dr. Alexander Bell, the inventor of the telephone, whom he assisted in the numberless experiments which culminated in the electrical transmission of speech. Acting under the instructions of Dr. Bell, he constructed with his own hands the first electric speaking

> telephone. He ran the first telephone wire. It was his keen ear which heard the first words ever transmitted by electricity. A leader among those who first introduced the telephone to the public, he was the first telephone engineer, and made fundamental contributions to the art of telephony, which are employed wherever the telephone is used.

The World War cast its exalting but terrible shadow across the lives of all the present generation. Mrs. Watson and I were in Scotland when it began and felt the solemnity of it as we saw England arousing herself to the struggle. In my memory remain sharp pictures of the stern faces of the British officers as they marched through the streets with their regiments on their way to France. At home, I did a little war work on a Massachusetts Committee, bought some Liberty Bonds, and gave readings and took part in the plays and pageants for the benefit of various war interests. I also backed financially a geological service started by Professor Douglas Johnson of Columbia University, to assist our armies in France by dealing scientifically with underground water supplies, location of trenches to avoid water-bearing layers, supplies of road metal and material for concrete, study of the reaction of different geologic formations to artillery fire and other problems requiring geological knowledge. But the job which was most satisfactory to me was keeping several hundred pairs of scissors sharp for the women's war work societies. No one can sharpen scissors better than I can and these were so dull that they had retarded the work badly. In these various ways I trust my services were of some assistance.

If I should speak of the purpose that has unified the manifold activities of my life, I would say that it is to be found in the fact that I have been wending my way eagerly to school all my life and am still at it. My conventional schools started me going, but my real schools have been my occupations and interests: clerking, bookkeeping, carpentering, machine shop, telephony, shipbuilding, geology, traveling, lecturing, acting, teaching, reading. Some of these may have been better than others, but I am sure they have all done something of everlasting good for me.

The summer of 1922 marks, perhaps, the last important epoch in my life. My wife and I spent that summer in the Colorado mountains. Toward the end of our stay there, we made a long excursion without a guide through some of the high valleys and passes of the beautiful region of forests and lakes, near Long's Peak. Mountains have always reminded me of my telephone days, probably because my first sight of them was so impressive on the notable day I spent in North Conway, New Hampshire, in December, 1876, when I talked with Alexander Graham Bell in Boston over the first long line on which we had tried the telephone.

Those superb Colorado peaks surrounding us on our walk brought back my telephone life with strange vividness. Every incident of the walk seemed to remind me of some telephone experience. Sunshine and storm, level stretches and hard climbs, smooth trails and rough trails, the fresh energy of morning, the fatigue of evening, even the flowers by the wayside—each and all tallied something in those days of my telephone work.

And, as if foreshadowing the final act of a drama, toward evening of the last day of our excursion a dense cloud swept down on us. It made us lose the trail and we wandered for hours without finding it, when suddenly the cloud lifted and we emerged into sunshine again with our camp close at hand.

When we reached our cabin that cloud took on a strange significance, for lying on my table was a telegram announcing the death that morning of Alexander Graham Bell, sent me by his wife. Our walk through the mountains had been the noble prelude to the coming of that message.

And with my sorrow for the passing of the man who had meant so much in my life came a sense of loneliness as I realized I was the last of the little group so closely and happily associated in our telephone struggles and successes nearly half a century before.

It cannot be long before I must follow my old associates into the cloud, but I have faith that the sun shines beyond.

(1)

THE END

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